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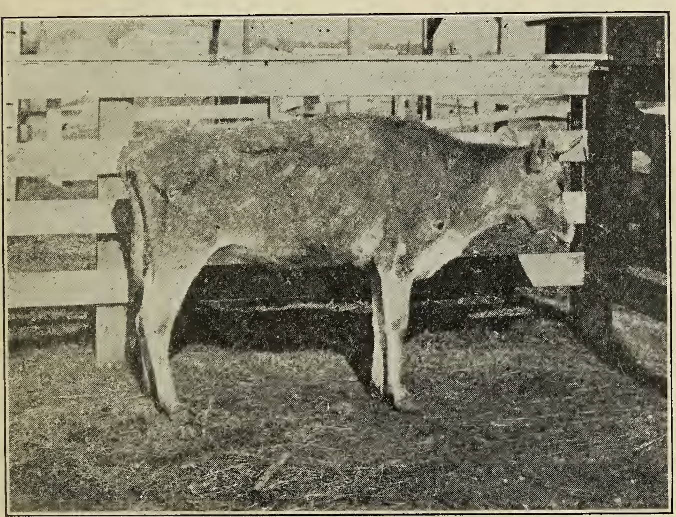
BATON ROUGE, LOUISIANA

JOHNE'S DISEASE
INFECTIOUS DIARRHEA OF CATTLE



AN INFECTED ANIMAL

By HARRY MORRIS

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JOHNE'S DISEASE
INFECTIOUS DIARRHEA OF CATTLE

By
HARRY MORRIS

During the past year a cow on the University farm developed a case of chronic diarrhea which would not respond to treatment. A definite diagnosis of Johne's disease was made by the Department of Animal Pathology, of the Louisiana Experiment Station.

For a number of years reports of similar cases have been received from different parts of Louisiana. One outbreak occurred in a herd of purebred short-horns in the northern section of the state. Several animals were lost, but the cause of the disease was never fully determined.

This brief report and description of Johne's disease is given for the benefit of the veterinarians of the state and for the cattle owners in general. It is hoped that it will materially assist in the diagnosis and control of this disease before it becomes a menace to the cattle industry of the state.

DESCRIPTION

Johne's disease is commonly known as chronic bacterial dysentery, infectious diarrhea, or paratuberculosis. It is a relatively new disease in the United States, having first been diagnosed in Pennsylvania in 1908. It is now known to exist in eight or nine states and is quite prevalent in certain dairy districts of the north. This disease is very common in the dairy districts of Europe, especially in Germany, Denmark, Holland, Belgium, Norway, and Sweden. Losses in Denmark probably approximate 10 per cent.

CAUSE

Johne's disease is caused by an acid-fast organism (Mycobacterium paratuberculosis) very similar to that of tuberculosis. It is aerobic, non motile, and does not produce spores. It is found in the intestinal mucous membrane and the mesenteric lymph glands of the infected animal.

SUSCEPTIBILITY

Cattle of all ages are susceptible to the disease, however, it is more prevalent in animals from two to four years of age. It usually appears in dairy cows during the second period of lactation.

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PLATE 1. HEALTHY INTESTINAL WALL

The normal intestinal wall shows a smooth, velvety mucous membrane when slightly stretched. Intestine split open and stretched on a flat surface.

SYMPTOMS

At least six months elapse after the animal picks up the infection before physical symptoms appear. The most characteristic symptom is the appearance of diarrhea with a gradual loss of flesh; the animal becomes a walking skele-

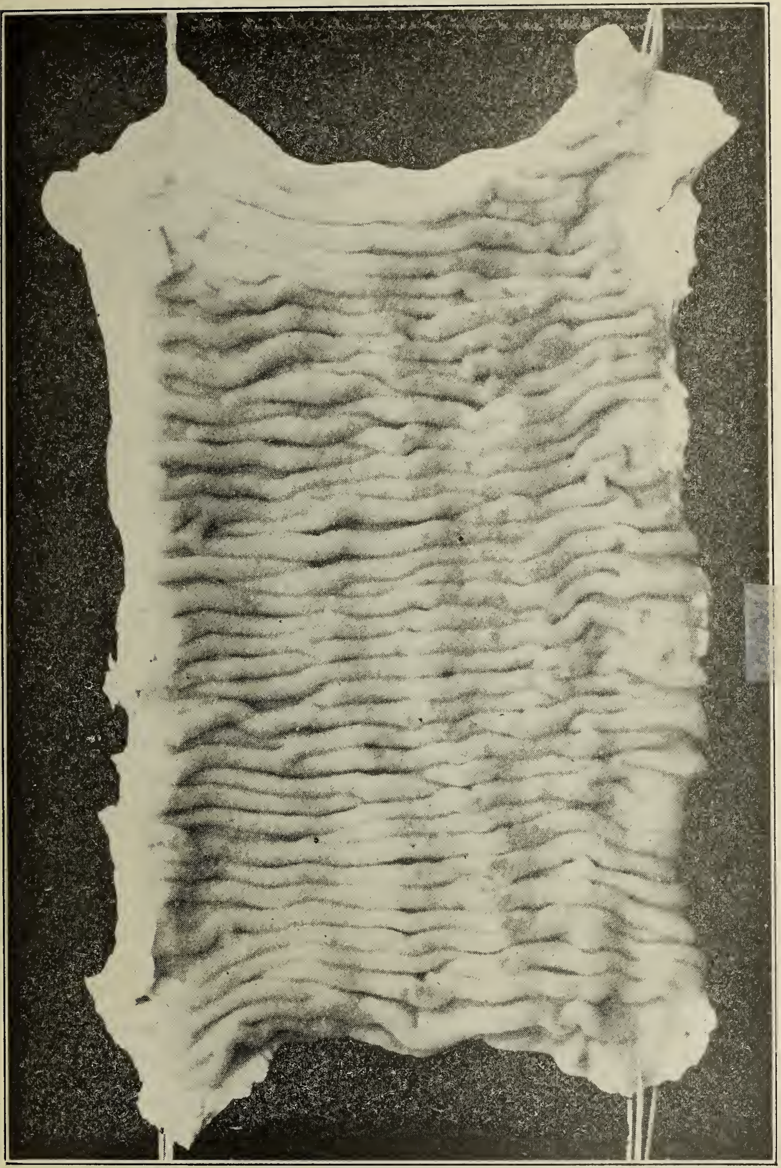

PLATE 2. DISEASED INTESTINAL WALL

This specimen was taken from the animal whose picture appears on the front page. Note the wrinkled condition of the mucous membrane, as compared to the normal intestine as shown in Plate 1.

ton. The milk flow is decreased, and the thirst of the animal is increased. The appetite is usually normal throughout the course of the disease. In the early stages the symptoms of diarrhea may disappear for a short space of time only to reappear in a more virulent form. The feces are thin, watery, and frequently contain gas bubbles and flakes of mucous. The hind quarters of the animal become soiled, as well as the floors and walls of the stable. The animal may live for months, but the disease finally terminates in death.

DIAGNOSIS

In making a diagnosis of Johne's disease, the physical symptoms should be taken into consideration, especially the chronic course: normal appetite of animal, increased thirst, and general emaciation. A post-mortem will show a general anemic condition; nothing pathological will be noticed except a thickening of the intestinal walls with the mucous membrane thrown up in folds or ridges, as is shown in Plate II. The draining lymph glands are usually enlarged. Slides made from scrapings of the intestinal walls will usually show the presence of the causative organism. The slides should be prepared as for tuberculosis, and sent to the Department of Animal Pathology, of State Experiment Station, for microscopic examination.

A diagnosis of Johne's disease may be made by applying a specific test, similar in nature to the tuberculin test. This test consists of injecting a preparation, known as "johnin," into the blood-stream of the animal. The infected animal will show a rise in temperature, often accompanied by symptoms of chills and diarrhea.

DIFFERENTIAL DIAGNOSIS

In Louisiana, Johne's disease may be confused with other troubles. Tuberculosis of the bowels might produce similar symptoms. This condition, however, is easily diagnosed by running the tuberculin test. A heavy infestation of either stomach worms or hook worms will produce emaciation and diarrhea in young cattle. Parasitic infestation usually appears in a great number of animals at the same time and is easily diagnosed, by a fecal examination for the presence of eggs, or by a post-mortem examination. In certain sections of the state a deficiency disease, commonly called "Creeps," might be confused with this disease. Similar conditions of emaciation and diarrhea may develop during the winter months among under-nourished cattle, but when proper nourishment is supplied to such animals the symptoms disappear.

TREATMENT AND PREVENTION

There is no treatment for Johne's disease, but it may be prevented. All suspicious cases should be isolated from the herd, as the infection is present in the feces of the animal. Grass, hay, or other food may become contaminated in this manner and prove a means of spreading the disease. If a single case appears on a farm, the entire herd should be tested, and all the reactors eliminated, as is done in the case of tuberculosis.

CONCLUSIONS

The Louisiana Experiment Station desires to obtain information concerning the possible presence of this disease in the state, so that proper control measures may be put into operation by the state sanitary authorities. Our warm semi-tropical climate might be ideal for the dissemination of this disease, nothwithstanding the fact that it is usually more prevalent in colder climates.

At the present time it is somewhat difficult to obtain johnin for diagnostic purposes. Dr. B. A. Beach, Department of Veterinary Science, University of Wisconsin, kindly supplied the department with enough johnin for this case. Dr. Beach has been working on this subject for many years and has contributed many valuable articles concerning the diagnosis and control of the disease.

The Bureau of Animal Industry, of the United States Department of Agriculture, realizes the importance of this disease in the United States. They hope to include paratuberculosis with the extensive tuberculosis eradication campaign, which is being carried on throughout the country. It is sincerely hoped that this plan will be put into operation as it will greatly facilitate the diagnosis and control of the disease.

SUMMARY

1. A case of Johne's disease has been definitely diagnosed in Louisiana.
2. This animal was purchased by the University from a breeder in the state.
3. No additional cases of the disease have developed on the farm.
4. The causative organism is disseminated in the feces of the infected animal.
5. Susceptible animals contract the disease from contaminated food and water.
6. All cases of chronic diarrhea, especially in dairy cattle, should be isolated and a veterinarian consulted.
7. If johnin is obtainable such animals should be tested and all reactors destroyed.
8. At the present time this disease is not a serious menace to the dairy industry of the United States.
9. All cases of Johne's disease should be reported to the Louisiana Livestock Sanitary Board.

It is hoped that this bulletin will assist in the diagnosis and control of Johne's disease before it becomes disseminated throughout the state. Imported animals should be carefully guarded to prevent its introduction into clean herds. It is always easier and cheaper to control a few cases of any disease in the beginning rather than to eradicate it after it has become widespread, as is the case of bovine tuberculosis.

The author wishes to express his appreciation to Dr. C. W. Edgerton, plant pathologist, and Dr. Herbert Spencer, assistant entomologist of the Louisiana Experiment Station, for the photographs appearing in this publication. Also to Mr. V. C. Owens, of the Dairy Department, for assistance given in this work.

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LOUISIANA STATE UNIVERSITY
AND
AGRICULTURAL AND MECHANICAL
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AGRICULTURAL EXPERIMENT STATIONS
W. R. DODSON,
Dean and Director

BATON ROUGE, LOUISIANA

INSECTICIDAL CONTROL FOR SUGARCANE BORER

A REPORT OF PROGRESS

301

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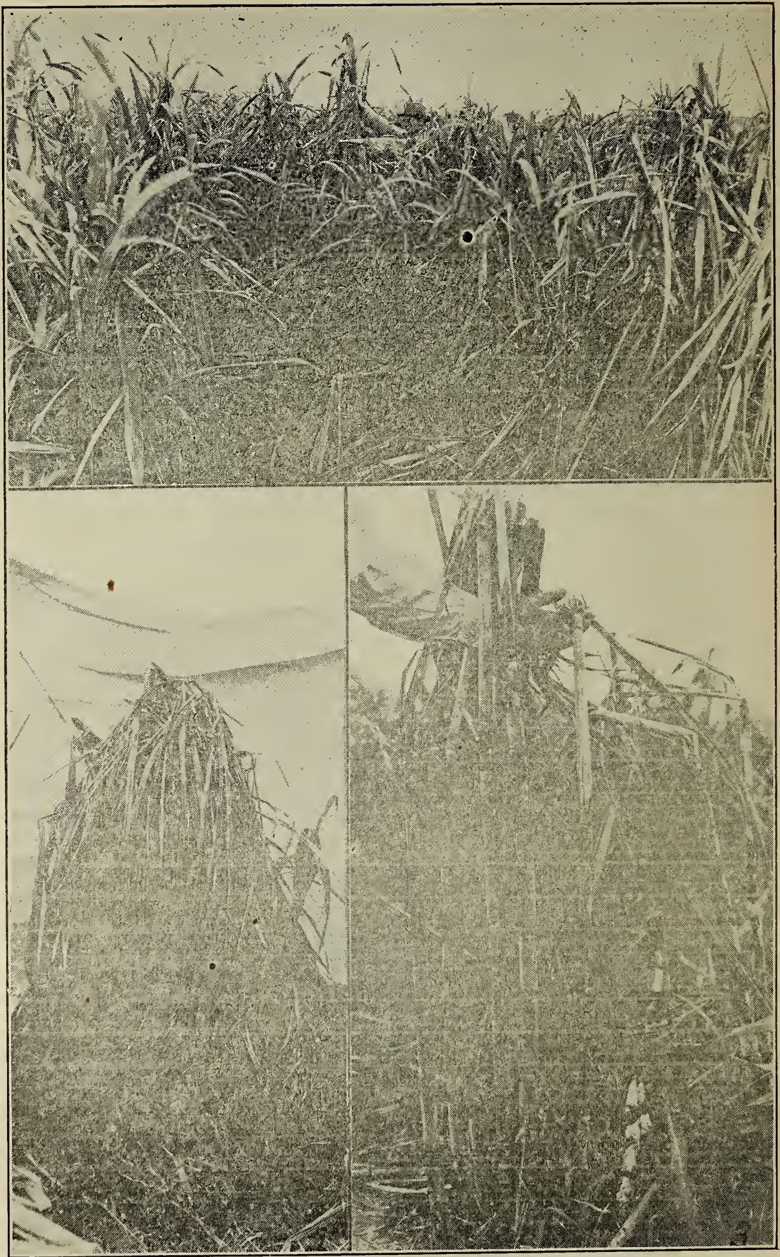
By W. E. HINDS and HERBERT SPENCER



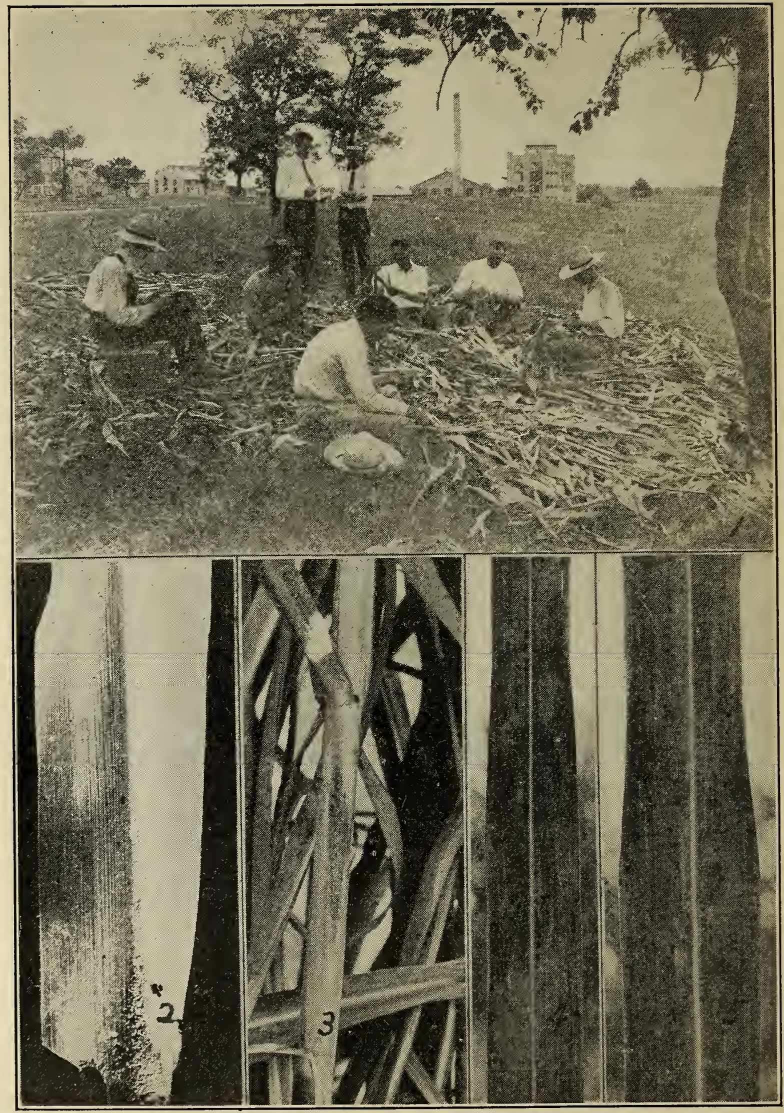
SUGARCANE COMPLETELY DESTROYED BY BORER WORK IN 1925

Plate I. Fig. 1, Nearly all tops down by end of September; Fig. 2, Close view of stool completely killed; Fig. 3, View of same stool with leaves removed showing stalks riddled by borers and dead in November. This is an extreme illustration of borer damage possibilities in years of heavy infestation.

PREFACE

This Bulletin contains a report of progress in the insecticidal control of the sugarcane borer *(Diatraea saccharalis crambidoides* Grote). This work started by the Entomologist in September, 1925, when a borer infestation of unprecedented severity was being experienced, has been continued since as the principal investigation of the Department of Entomology. The Assistant Entomologist has given most of his time to this investigation. Special acknowledgments are due to Messrs. B. A. Osterberger and C. L. Stracener, Assistants in Entomology, for their faithful efforts and to the large number of student assistants who have participated in the field work and without whom the mass of data accumulated could not possibly have been secured.

Invaluable cooperation has been given also by a large number of sugarcane planters, and especially by Messrs. A. Wilbert's Sons & Co. of Plaquemine, La., who cooperated in putting on the large-scale field dusting of cane which was done in September and October, 1926 on several of their plantations and in which they bore a large share of the expense. The Huff Daland Dusters, Inc., are also due our very grateful acknowledgments for their cooperation in providing gratis the airplane and staff required in putting on the 1925 dusting tests and for sharing very generously in bearing the application expense for making the extensive experiments covering nearly 1300 acres of cane in the fall of 1926. A number of manufacturers and jobbers have also assisted greatly through their donation, or special preparation of materials required in this work. We thank all such cooperators.



DETERMINING RESULTS OF DUSTING FOR BORER CONTROL

Plate II. Fig. 1, Cutting up corn or cane to determine borer population and mortality from dusting; Fig. 2, Sodium silicofluoride dust accumulated at base of leaf where most effective; Fig. 3, "Sheath burn" occurring commonly on loosened leaf sheaths (not considered important); Figs. 4 and 5, "Leaf splotch burn" occurring frequently on blades of mature leaves but very rarely seen on upper whorl leaves. This is considered as being the most important type of leaf burn.

INSECTICIDAL CONTROL FOR SUGARCANE BORER

By W. E. Hinds, Entomologist, and Herbert Spencer, Asst. Entomologist.

EARLIER WORK

In 1902, H. A. Morgan, then Entomologist of the La. Experiment Station published in Bulletin No. 70, Second Series, the best known recommendations for borer control which were considered practicable at that time. These include no mention of any insecticidal tests, but advised principally the cutting out of "dead hearts" and the burial of unburned, infested remnants of cane.

In Bull. 746, U. S. D. A., by Holloway and Loftin, 1919, is found a report of a rather extensive test of the possibility of controlling the borer by dusting the young cane with arsenate of lead. This work was conducted in 1916 and 1917 and included from one to four applications at a rate of about 2 lbs. per acre each. The conclusion from this work at the end of the season, as stated on page 44, was as follows: "No relationship between the poisoning and borer infestation could be established, the treatment evidently having no effect whatever."

INSECTICIDAL TESTS IN 1925

Up to this time no effort at insecticidal control for the cane borer had given encouraging results. The difficulty of the borer control problem is perhaps indicated more clearly by this fact than by any other single fact learned during the thirty years that it has been studied in this State. There are many very evident difficulties in the way of applying insecticides to full-grown sugarcane and especially in reaching and destroying the larger larvae which are burrowing in the bases of the stalks of sugarcane, corn, sorghum or other food plants. These larvae usually make their entrance into the stalks at a point sheltered and protected by the leaf sheath. In the process of their development from egg to adult the young larvae feed for about the first week of their life within the shelter of the leaf roll. The third stage larvae may feed here or may burrow into the mid-rib of a leaf or may burrow into the stalk usually near the growing point. The fourth and fifth stage larvae move on lower down the stalk, as a rule, but the only feeding which they do on the exterior of the cane is for their own entrance and exit holes and the opportunity for killing them through any poison adhering to the surface of the stalk is very slight indeed.

Early in the season it is possible to apply insecticide materials, either dusts or sprays, to the young cane but borer infestation is usually light in the cane at that time. The borer attack becomes serious by the last of July or first of August and at that time cane is usually at least six feet in height and overlapping between the rows. It then becomes very difficult, if not impossible, to use either hand or ground machines for applying insecticides in such fields.

FIRST AIRPLANE DUSTING WORK ON SUGARCANE

In spite of these difficulties it was felt in August, 1925, that an effort should be made to destroy the borers in cane by means of calcium arsenate dust which had been used very satisfactorily for a number of years in the control of the boll weevil in cotton. Accordingly arrangements were made for the location of the tests on Homestead Plantation, across the Mississippi River from Baton Rouge, with the Huff Daland Dusters furnishing the airplane for the work. On the evening of September 4, 1925, 17 acres of cane were dusted with 200 pounds of calcium arsenate. Four days later a second application was made on one-half of this area, using the same material and poundage. Careful examination showed that calcium arsenate alone had practically no effect in killing cane borer larvae, either in the tops or within the stalks.

On September 13 about 5 acres of cane at the Sugar Experiment Station were treated with a mixture of calcium arsenate to which 5% by weight of dextrine had been added. The application was at the rate of 12 pounds per acre. With this mixture nearly 20% of the borer larvae were killed but this percentage was too low to be considered satisfactory.

Also on September 13, and as a final application made by the airplane before it left Baton Rouge, a sample lot of 35 pounds of a commercial brand of sodium silicofluoride was applied to about 2 acres of D-95 cane. Upon cutting up a number of canes thus dusted, there were found in 10 canes: 6 larvae dead; 1 larva alive; 2 pupae alive and 2 empty skins. In the preceding work with calcium arsenate it was found that the natural mortality among larvae more than half-grown was less than 2%. Therefore, the finding of a mortality apparently between 60% and 70% gave unmistakable evidence of effectiveness on the part of the poison used and constituted what we believe to be the first really positive, favorable results from insecticide applications to sugarcane for borer control. This gave the clue that has been followed since in our insecticidal work with the borer. It appeared that there was some burning of foliage in the area treated with silicofluoride and the material as used was in a very poor condition for dusting. It was so lumpy that it had to be worked through a screen before it could be used at all. The cane quickly outgrew the burning effect and so far as we could judge there was no serious injury to the growth of the cane.

HAND DUSTING EXPERIMENTS WITH SODIUM SILICOFLUORIDE IN 1925

As quickly as materials could be secured, further experiments using hand dusters were instituted to compare the effectiveness of several brands of commercial materials. The results of these preliminary hand tests are shown in Table No. 1.

TABLE No. 1. HAND DUSTING TESTS WITH SODIUM SILICOFLUORIDE MATERIALS IN 1925.

Material	Date Applied 1925	Date Examined 1925	Cane Variety	Larvae Killed, No.	Larvae Alive No.	Percentage Dead
Jungmann's Extra Light	10/5	10/9	D-74	15	9	62.5
Jungmann's Light	10/5	10/9	D-74	10	9	52.6
Va.-Car. "Standard"	10/5	10/9	D-74	18	2	90
Jungmann's Light	10/5	10/12	D-95	8	4	66.7
Jungmann's Extra Light	10/5	10/12	D-95	9	2	81.8
Va.-Car. "Standard"	10/5	10/12	D-95	12	7	63.1
Armour's	10/5	10/12	D-95	13	5	72.2
Totals	....	....		85	38	69.2
Check examinations, no dust	....	10/9	D-74	1	26	3.7

This first hand dusting experiment was conducted on the Sugar Experiment Station, fertilizer plats, making use of the ends of the rows near the headlands. The dusts were applied in the late afternoon by means of an American Beauty Knapsack Duster. There was some slight leaf burning with most of these dusts. These tests were too limited to be considered at all conclusive but did confirm the previous results secured from the single application made by the airplane.

A second series of examinations from these hand gun applications was made at a later date to find whether the killing effect still continued to eleven days after the dust was applied. The results of these examinations are shown in Table No. 2.

TABLE No. 2. EFFECT OF SODIUM SILICOFLUORIDE MATERIALS 10 TO 14 DAYS AFTER APPLICATION.

Material	Date Applied 1925	Date Examined 1925	Cane Variety	In Leaf Sheaths		In the Stalks		Total Stages	Per Cent Kill
				Dead No.	Alive No.	Dead No.	Alive No.		
Armour's	10/5	10/16	D-74	1	7	2	9	19	15.8
Jungmann's Extra Light	10/5	10/16	D-74	3	2	0	6	11	27.6
V-C Standard	10/5	10/17	D-74	2	2	1	4	9	33.3
Jungmann's Light	10/5	10/19	D-74	1	1	1	12	15	13.3
			Totals	7	12	4	31	54	20
Undusted Check	....	10/19	D-74	0	8	0	7	15	0

No rain fell at Baton Rouge from October 5 to 14 inclusive, but on the 15th, 16th and 17th there was a total of 2.32 inches rainfall according to the U. S. Weather Bureau Reports. It is quite apparent from the data summarized in Tables No. 1 and No. 2 (see also Tables 18 and 19) that the maximum percentage of kill that may be found at any one time upon cutting up stalks treated with sodium silicofluoride will be found on about the fifth to seventh days after the application is made. Beyond this time the toxic effect appears to decrease. This result would be expected for several reasons: first, because of the gradual loss of poison from the plant due to the action of dews and rains; second, because of new growth which occurs during the interval; third, because of the removal of dead young stages from the leaves by winds and rains, and by the decomposition and drying up of older stages within their burrows so that they are not recognized in the course of the examination. Table No. 2 should be considered only as supplemental to the results shown in Table No. 1. No mortality records taken in this way can ever be quite complete and such records must necessarily be conservative in their indications as to the actual total mortality occurring in the field.

Observations as to the burning effects of these various dusts showed that there was little difference between the brands used in this series of tests. In the axils of some of the leaves where the dust settled in largest quantity, the tissues were reddened slightly and in some cases later became brown and dried out. In no case did the injury appear to be serious and the young tender sprout growth at the base of the stools appeared to be entirely free from leaf burn.

In another series of hand gun applications an effort was made to determine whether the addition of hydrated lime would reduce the burning effect on the foliage of cane. These results are shown in Table No. 3.

TABLE No. 3. BURNING EFFECTS OF SILICOFLUORIDE DUSTS ON CANE AND CORN WITH AND WITHOUT HYDRATED LIME.

Materials: Silicofluorides	Date Applied 1925	Date Examined 1925	Variety	Burning Effect on Leaves
Jungmann's Light	10/23	11/10	D-74 Stubble	Very slight
Jungmann's Light, 2/3 Hydrated lime, 1/3	10/23	11/10	" "	None
Jungmann's Extra Light	10/28	11/10	" "	Very Slight
Calcium silicofluoride	10/28	11/10	" "	None
Jungmann's Extra Light, 1/2 Hydrated lime, 1/2	10/28	11/10	" "	None
Calcium silicofluoride	10/28 and 11/9	11/10	" "	None
Jungmann's Extra Light	10/28 and 11/9	11/10	" "	Slight
Jungmann's Extra Light, 1/2 Hydrated lime, 1/2	10/28 and 11/9	11/10	" "	None
Calcium silicofluoride	11/9	11/14	Corn	None
Jungmann's Extra Light, 1/2 Hydrated lime 1/2	11/9	11/14	Corn	Slight
Jungmann's Extra Light	11/9	11/14	Corn	Severe

The foregoing dusts were applied by means of a Root hand duster and with a rather heavy application. It appears that with the straight commercial material there was slight burning to cane and severe burning to corn where no hydrated lime was used with sodium silicofluoride. The addition of one-third or one-half by weight of hydrated lime reduced the burning effect to a negligible amount on corn and so that no burning whatever was noticeable on cane of D-74 variety. These tests did not include applications to borer-infested plants to determine the effect of the addition of lime upon the toxicity to borer larvae.

DUSTING TESTS IN 1926

In order to carry further the investigation as to the effects of repeated applications of silicofluoride materials upon the foliage and the growth of cane, five series of dusts were applied to four varieties of cane, including D-74, D-95, Purple and Striped.

The sixth plat was left undusted for a check plat. The dates when dust applications were made and the materials used were as follows:

May 10, 11, 17, 20; June 2; August 7.

Series No. 1—Virginia-Carolina Chemical Co., "High Grade" Sodium silicofluoride.

Series No. 2—Armour Fertilizer Co., Sodium silicofluoride.

Series No. 3—Victor Chemical Co., Calcium silicofluoride.

Series No. 4—Jungmann's Extra Light Levosol (Sodium silicofluoride).

Series No. 5—Jungmann's Light Levosol (Sodium silicofluoride) with equal parts Hydrated lime.

Series No. 6—No dust, Check Plat.

At the time of the first application the cane was about 2 ft. high and growing rapidly. On the afternoon of May 10 there was a rainfall of 1.16 inches therefore the dusting was repeated next day. Following the third application, there was a rainfall of 1.44 inches on May 19, two days after the dust was applied. During June the rainfall occurred on 9 days amounted to a total of 4.06 inches.

Among the four varieties of cane tested, D-95 appeared to be somewhat more susceptible to burning than the other varieties. This appeared in the form of a slight "marginal burn" on the edges of the younger leaves in Series No. 1, No. 2 and No. 4. Series No. 3 and No. 5 were entirely free from burn as was the undusted check. In all of these tests the evidence of slight leaf burn soon disappeared with the maturity of lower leaves. There was no checking of growth apparent and at the end of the season it was impossible to distinguish the limits of the dusted areas through any apparent difference in the growth of the cane.

EFFECTS OF FLUORINE DUSTS ON BORER LARVAE.

In the spring of 1926 borer infestation in cane appeared to be light and there were not enough borers present to justify dusting experiments on cane until the last of July. However the infestation in corn was comparatively very much heavier and was sufficient to permit the beginning of dusting tests by the first week in July, because the number of borer stages to be found in corn was so much greater than that in cane all of the preliminary tests of dusts for their effect upon the borer were made on corn. The experiments and observations in Series No. 8 are given below and apply to the second generation of borers.

TABLE No. 4. EFFECT OF FLUORINE DUSTS ON BORER STAGES IN CORN, JULY, 1926.

Dust Materials	Date Applied 1926	Date Examined 1926	No. Stalks Examined	Borers Dead	Borers Alive	Per Cent Dead	Leaf Burn
Virginia-Carolina Sodium silicofluoride	7/6	7/9	37	89	43	67	Severe
Jungmann's Extra Lt. Sodium silicofluoride	7/6	7/9	55	112	57	66	Severe
Cryolite Mixture	7/6	7/9	41	14	84	14.2	Very slight
Cryolite	7/6	7/9	50	69	78	47	Very slight
Fluospar	7/7	7/10	42	33	71	31	Very slight
Aluminum fluoride	7/7	7/10	50	81	33	71	Moderate
Wiarda's Sodium silicofluoride	7/7	7/10	48	37	43	46	Severe
Victor's Calcium silicofluoride	7/7	7/12	43	10	64	13.5	None
Check—No dust	....	7/12	50	3	168	1.7	None

Of the foregoing materials all of the sodium silicofluorides were quite effective in killing cane borer larvae. Aluminum fluoride also gave promising results.

In the next series of dusts, Series No. 9, the applications were also made to corn for the second generation of borers. The first four dusts were applied on the morning of July 13. Practically an inch of rain fell on the same day. The balance of the dusts were applied on the following day and no rain occurred from this time to the examinations.

TABLE No. 5. EFFECT OF FLUORINE DUSTS ON BORER STAGES IN CORN, JULY, 1926.

Dust Materials	Date Applied 1926	Date Examined 1926	No. Stalks Examined	Borers Dead	Borers Alive	Per Cent Dead	Leaf Burn
Jungmann's Extra Light with 10% Hydrated lime	7/13	7/16	56	97	44	68.7	Slight
Jungmann's Extra Light with 25% Hydrated lime	7/13	7/16	50	55	40	57.8	Slight
Virginia-Carolina Sodium silicofluoride	7/13	7/19	41	34	17	66.6	Severe
Cryolite	7/13	7/19	56	44	26	62.8	Moderate
Jungmann's Extra Light	7/14	7/19	45	15	29	34.1	Slight
Aluminum fluoride	7/14	7/19	52	41	92	30.8	Slight
Fluospar	7/14	7/19	50	9	97	8.4	Severe
Jungmann's Light Sodium silicofluoride	7/14	7/20	52	19	20	48.7	Moderate
Check—No dust	....	7/20	50	3	73	3.9	None

The results of this series of tests confirm closely those obtained in Series No. 8. It appears that the addition of 10% of hydrated lime is advisable as it evidently decreases the burning effect on foliage but does not decrease greatly the killing effect on borer larvae. The addition of more lime appears to decrease the toxicity to borers directly as the lime is increased and does not further reduce the tendency to burn foliage.

A still more extensive series of dust applications was made during the following week under Series No. 10 and is reported in the table following:

TABLE No. 6. EFFECT OF FLUORINE DUSTS ON BORER STAGES IN CORN, JULY, 1926.

Dust Materials	Date Applied 1926	Date Examined 1926	No. Stalks Examined	Borers Dead	Borers Alive	Per Cent Dead	Leaf Burn
Hydrated lime, alone	7/22	7/26	50	1	36	2.7	None
Dusting sulphur	7/22	7/26	50	3	89	3.3	None
Jungmann's Extra Lt.	7/22	7/26	50	32	21	60.4	Moderate
Jungmann's Extra Lt. with 10% Hyd. lime	7/22	7/26	53	43	19	68.4	Slight
Jungmann's Extra Lt. with 10% Sulphur	7/22	7/26	50	12	36	25	Moderate
Cryolite	7/23	7/28	47	4	33	10.8	Very slight
Cryolite and 10% lime	7/23	7/28	45	6	33	15.4	Very slight
Cryolite and 10% Sulphur	7/23	7/29	50	12	23	34.3	Very slight
Jungmann's Light	7/23	7/28	62	39	18	68.4	Severe
Jungmann's Light with 10% Hyd. lime	7/23	7/27	50	12	17	41.4	Moderate
Jungmann's Light with 10% Sulphur	7/23	7/27	55	20	25	44.4	Severe
Jungmann's Light with 50% Fluospar	7/23	7/28	40	7	13	35	Moderate
Va.-Car. Sodium Silicofluoride	7/23	7/27	24	13	8	61.9	Severe
Va.-Car. with 10% lime	7/23	7/27	59	38	23	62.3	Severe
Va.-Car. with 10% Sulphur	7/23	7/29	51	34	48	41.5	Severe
Va.-Car. with 25% lime	7/23	7/28	51	21	24	46.7	Moderate
Lead Arsenate	7/23	7/28	51	0	33	0	None
Lead Arsenate with 50% Jungmann's Light	7/23	7/27	45	15	21	41.7	None
Iron Arsenate	7/23	7/27	50	4	51	7.3	None
Check—No dust	———	7/27	50	1	23	4.2	None

The results in borer control as well as in the degree of foliage burning in the foregoing series are closely in accord with those observed in preceding tests.

In dusting Series No. 11, an effort was made to learn whether precipitated chalk (calcium carbonate) might be preferable to hydrated lime (calcium hydroxide) as a diluent with sodium silicofluoride to prevent the burning of foliage. The applications were made to small plats of D-95 and D-74 cane and also to corn. The dust was applied rather heavily. The second night a thunder shower occurred with a rainfall of about .30 inch. The dusts used were the following:

A—Jungmann's Extra Light sodium silicofluoride, alone.

B—Jungmann's Extra Light sodium silicofluoride, with 10% hydrated lime.

C—Jungmann's Extra Light sodium silicofluoride, with 10% precipitated chalk.

The foregoing dusts were applied on August 7, 1926. Subsequent examinations showed no burning with any of the dusts on cane. On corn, however, there was moderately severe burning with all three dusts but slightly less where the hydrated lime was used. These tests indicated again that it is advisable to use a small amount of hydrated lime with sodium silicofluoride and also that this material is apparently preferable to precipitated chalk, or calcium carbonate, as a diluent.

BURNING EFFECTS ON FOLIAGE OF CORN AND CANE

In dusting Series No. 12, to test burning effects on foliage of corn and D-74 cane, a number of new materials were included and the summary of these tests follows: The dusts were applied August 10 and examinations made August 16.

TABLE No. 7. FOLIAGE BURNING EFFECTS ON CORN AND CANE, AUGUST, 1926.

Test No.	Materials Tested	Burning Effect on Foliage of	
		Corn	Cane
1	Jungmann's Extra Light Sod. silicofluoride	Moderate	Very slight
2	Ambrusters Calcium fluoride	None	None
3	Magnesium silicofluoride with 50% wood dust	Moderate	Very slight
4	Magnesium fluoride	Slight	None
5	Calcium fluoride	Very slight	None
6	Barium silicofluoride	Slight	Very slight
7	Calcium silicofluoride	Moderate	None
8	Magnesium silicofluoride with 50% wood dust	Moderate	None
9	Barium fluoride with 50% wood dust	Slight	None
10	Barium fluoride	Moderate	Severe
11	Calcium fluoride	Slight	None
12	Magnesium silicofluoride	Severe	Slight
13	Barium silicofluoride with 50% wood dust	Moderate	None

From the preceding tests it would appear that some of the fluorides may be less toxic to foliage than their corresponding fluosilicates. The wood dust used was prepared from Balsa wood, which is an exceedingly light material, which would be chemically inert in either the dry condition or in the presence of water. Its action was expected to be principally as a light-weight diluent which might promote a better distribution of the active insecticidal material. It did not appear to help much in this way. During the period between the application of these dusts and the examination for burning effect, rain fell on four days with a total of more than 4 inches. None of these materials appeared to be safer to foliage or superior in dusting quality to Jungmann's Extra Light sodium silicofluoride with 10% hydrated lime.

The results from the next two series of dusts, Series No. 13 and No. 14, are combined in the following table for the sake of brevity. The results of examinations made three days apart on each dust are combined and averaged to show the percentage of kill with each material.

TABLE No. 8. EFFECT OF FLUORINE DUSTS ON BORER STAGES IN CORN, AUGUST, 1926.

Dust Materials	Date Applied 1926	Date Examined 1926	No. Stalks Examined	Borers Dead	Borers Alive	Per Cent Dead	Leaf Burn
Jungmann's Extra Light	8/17	8/20, 23	26	20	27	42.5	Moderate
Jungmann's Extra Light with 10% lime	8/17	8/20, 23	33	15	25	37.5	Slight
Aluminum fluosilicate	8/17	8/20, 23	24	18	34	34.6	Very slight
Barium fluosilicate	8/17	8/20, 23	28	14	12	53.8	None
Barium fluoride	8/17	8/20, 23	28	12	11	52.1	Burned
Wiarda's Calcium fluosilicate	8/17	8/20, 23	32	13	16	44.8	Very slight
Wiarda's Calcium fluoride	8/17	8/20, 23	25	13	38	25.5	None
Ambruster's Calcium fluoride	8/17	8/20, 23	25	5	53	8.6	None
Magnesium fluosilicate	8/17	8/20, 23	24	16	12	57.1	Slight
Magnesium fluoride	8/17	8/20, 23	27	7	15	31.8	Slight
Check—No dust	———	8/23	25	5	42	10.6	None

Summary of Results of 1926 Hand Dusting Tests on Corn, Comparison of Principal Materials Used, With and Without Lime

In order to present clearly a brief comparison of the principal dusts used in the preliminary hand dusting tests on corn at the Experiment Station in 1926, we have brought together the figures from several of the foregoing tables and grouped them by materials. This comparison shows the basis for selecting the safest and most generally effective and satisfactory dust for use in much more extensive field tests later in the season. This field application was impossible with any existing type of hand or ground dusting machine but because of previous extensive and satisfactory experience in the use of airplanes in dusting cotton for cotton boll weevil control, and in the initial small-scale use of airplanes in dusting sugarcane in September, 1925, arrangements were made for applying the most promising insecticide material found in this preliminary work upon a plantation scale later in the season by airplanes.

TABLE No. 9. COMPARISON OF MOST PROMISING DUSTS USED IN HAND DUSTING WORK—1926.

Description of Dust	No. of Tests Made	Period of Tests	No. Stalks Examined	Total Borer Stages	No. Stages Dead	Per Cent Stages Dead	Foliage Burn: Corn
Jungmann's Extra Light Levosol—Straight	4	7/6-8/17	188	309	183	59.2	Generally severe
Jungmann's Extra Light with 10% Hyd. Lime	3	7/14-8/17	145	243	155	63.8	Generally slight
Jungmann's Extra Light with 25% Hyd. Lime	1	7/14-16	50	95	55	57.9	Slight
Jungmann's Light Levosol—Straight	2	7/15-28	114	96	58	60.4	Severe
Jungmann's Light with 10% Hyd. Lime	1	7/23-29	49	54	21	38.8	Severe
Virginia-Carolina "Standard"—Straight	3	7/6-27	102	206	138	67	Severe
Virginia-Carolina with 10% Hyd. Lime	1	7/23-28	59	61	38	61.9	Severe
Virginia-Carolina with 25% Hyd. Lime	1	7/23-29	50	38	11	28.9	Moderate
Wiarda's Sodium Silicofluoride—Straight	1	7/7-10	48	80	37	46	Severe

SILICOFLUORIDES AS INSECTICIDAL DUSTS

In the course of this work it soon became evident that there exists a very large degree of variation in the qualities, safety and insecticidal value of various brands of materials which may all be purchased under the name of "Sodium silicofluoride." First of all there is great variation in physical texture, in the fineness of particles and in the dusting properties. The use of this material as an insecticide is a development of the past three or four years. The principal market for the material has been for purposes which did not desire a fine dust. Consequently the manufacturers have produced, in most cases, a rather coarsely crystalline type of material which flows freely like fine sand but does not contain any large proportion of material of such fine texture as to rise easily in a dust cloud as the material is handled. It appears, therefore, that the development of this material for insecticidal purposes may involve very material changes in its physical properties.

Field experiments indicated that there may be also a great deal of difference in the chemical composition, or at least in the toxic effects to plant foliage and to insect stages, of different brands of sodium silicofluoride materials. All of the nearly chemically pure, undiluted commercial brands thus far tested have shown too high a degree of burning of the foliage of corn and of sugarcane to justify a recommendation for their general application, although the killing of borer larvae by these undiluted commercial materials may be somewhat higher than with the same materials mixed with a proportion of some diluent material.

Examination of the preceding records indicates quite clearly that the addition of 10% by weight of hydrated lime to these commercial materials usually results in a perceptible decrease in their burning effect on the foliage of corn and of sugarcane. This combination results also in a slight decrease in the killing effect on borers. Increasing the proportion of hydrated lime above 10% decreased the borer kill more decidedly and did not seem to have a corresponding effect in preventing the further burning of foliage. Therefore our standard dust at present includes 10% of hydrated lime.

The factor of cost is an important element in any such insecticide material. Apparently a sodium silicofluoride can be made much more cheaply than magnesium or other silicofluoride, because the sodium salts (chloride) involved in the reaction are much less expensive than corresponding salts of magnesium, potassium or barium.

Disregarding the element of cost and seeking only to find the material which can be used with greatest safety and effectiveness, it is quite evident that much further investigation is deserved for barium and magnesium materials particularly. Among these materials also it appears that the fluosilicates are safer to the foliage and also more toxic to the insects than the corresponding fluorides.

It is worthy of note that the principle underlying the action of silicofluoride materials, especially in a problem like that of sugarcane borer control, is very different from that underlying the action of calcium arsenate in boll weevil control. With practically all of the arsenates, the water soluble arsenic is reduced to a very small proportion. In fact with high grade calcium arsenate there is usually less than one-fourth of one per cent of water soluble arsenic. Calcium arsenate kills because it is taken into the stomach of the insect which is feeding on the poisoned foliage and in the stomach is more or less dissolved by the action of the stomach juices. Practically all of the original application is ultimately washed off from the foliage by dews and rains without ever having been brought into real solution.

In contrast with this, sodium silicofluoride and most other fluorine dusts, are soluble to a certain extent in water. Naturally this solution gradually makes its way over the surface of the leaf, and with plants like corn and cane, much of it is conducted down the mid-rib channel of the leaf to the stalk and washes over the stalk thoroughly on its way to the ground. Upon evaporation there is a redeposit of the dissolved materials on the surface of the leaf stalk. This is again dissolved and spread by succeeding dews and rains and there may be a gradual increase in the water soluble elements until they have been completely removed from the plant. Apparently it requires more than two weeks of time and more than three inches of rainfall to accomplish complete removal of a sodium silicofluoride application. Undoubtedly any such rainfall immediately following an application will have some effect in decreasing its efficiency but in some tests the records have shown more than 50% of the borer larvae killed with certain dusts even when a rainfall of 1.3 inches occurred within two hours after the dust was applied. It seems fortunate indeed in this work that so large a portion of the value of a dust application may be secured in spite of frequent and even heavy rainfall.

WATER SOLUBILITY OF FLUORINE DUSTS

An examination of various fluorine dusts made in the State Chemical Laboratory through the cooperation of the Chief Chemist, A. P. Kerr, and his Staff, gives us some idea of the rate at which these materials are brought into solution on the plants. In these examinations 5 grams of the dust were placed in 95 c.c. of distilled water and kept at 30 degrees Centigrade for 24 hours. At the end of this time the amount of water soluble fluorides per 100 c.c. of solution was determined with the following results:

TABLE No. 10. WATER SOLUBILITY OF SODIUM SILICOFLUORIDE DUSTS.

Material Tested	Total % Water Soluble Fluorides	Milligrams Fluorine per 1 c. c. of Water
Wiarda's "Heavy"	58.80	4.28
Armour's Commercial	59.70	4.91
Virginia-Carolina "Standard"	60.80	5.20
Wiarda's "Light," with 37% Balsa wood	36.10	4.66
Jungmann's "Sample No. 315-22"	57.95	4.49
Jungmann's "Extra Light Levosol"	47.03	5.13
Jungmann's "Light"	53.20	4.82
Jungmann's "Light," with 10% Lime	38.00	4.34
Grasselli's Commercial	37.52	5.44

That a gradual solution of the water soluble portion of the dust takes place in the field where sodium silicofluoride dusts are applied to plants is shown clearly by the analyses of a few small samples of the liquid taken from the leaf sheath of cane which had been dusted 24 hours previously with some of these materials. No rain had fallen meantime but a heavy dew had formed and run down over the leaves and stalks. At many points the leaf sheath fitted tightly enough to retain a small quantity of water and from such points the water was collected with pipettes and later analyzed with the following results:

Sample No. 1, Virginia-Carolina dust, solution contained 0.98 grams sodium silicofluoride per 100 c.c.

Sample No. 2, Jungmann's "Extra Light," solution contained 0.084 grams sodium silicofluoride per 100 c.c.

Sample No. 3, Jungmann's "Light," solution contained 0.05 grams sodium silicofluoride per 100 c.c.

The foregoing analyses indicate clearly that small amounts of the material are dissolved in dew which runs down the leaf and collects in the axil where it remains for a short time at least and may become more concentrated and toxic as small fractions are added.

HOW SILICOFLUORIDE SOLUTIONS KILL BORERS

It is generally accepted as a fact that silicofluoride solutions act both as stomach and as contact poisons but so far as we are aware no detailed experiments have been recorded to show which effect is of principal importance. The following tests were undertaken to secure some information along this line. They are not considered at all as being of a final nature but rather of value only as indicating some general effects which may happen where silicofluoride dusts are applied for sugarcane borer control. It is doubtless true that the effect on the insect species may vary widely with different insects concerned. With the sugarcane borer there are usually five rather distinct stages or sizes in larval growth. The young larvae including the first and second and frequently the first part of the third stage or "instar" feed within the leaf roll and on the surface of the very tender leaf growth. It would appear to be practically impossible in field operations to force poison to a point where it would be dissolved and spread through the leaf roll so as to destroy a large proportion of first stage larvae. Larvae in this stage are largely responsible for making the "pin hole" perforations in the leaves which are the most striking sign of cane borer work on either corn or cane. After reaching the third stage, the larvae adopt the burrowing habit and from that time on do practically all of their feeding within the protection of such burrows.

The records which we have made regarding the effects of silicofluoride solutions on borer larvae were designed primarily to see whether there existed a distinct contact killing effect and to determine whether this might be an important factor in the total mortality secured from field applications of dusts. We would expect varying effects from varying degrees of concentration of solutions and from varying periods of exposure thereto. Undoubtedly also there may be a difference in the reaction of the insect according to its size or stage of development, and also according to whether it has just molted or is just about to molt. There is a distinct diminution in feeding activity before each molt occurs and if contact effects are experienced we would expect them to be greatest immediately after a molt. Naturally also temperature conditions have much to do with the physiological activity of the insect in any stage.

These tests were conducted in the Laboratory during the period from November 30 to December 13, 1926. The room was steam heated and during the day temperatures of from 72 to 78 degrees F. occurred. The temperature at night was very much lower but never as low as outside temperature. In the late fall there is a distinct tendency among the larvae more than two-thirds grown to form a protective cell within which to pass the winter and feeding practically ceases. The significant details from the observations on more than 60 larvae are stated as briefly as possible in Table No. 11.

TABLE No. 11. CONTACT POISON EFFECTS OF SILICOFLUORIDE SOLUTIONS, BATON ROUGE, LA.—NOVEMBER 30 TO DECEMBER 13, 1926.

Stage of Larva	Nature of Treatment	Duration of Treatment Minutes	Remarks on Effects of Treatment
	Tests with Saturated Solution of Wiarda's "Heavy"		
2	Submerged	1	Alive on fresh food for 10 days.
2	Submerged	1/6	Alive on fresh food for 13 days.
5	5 Drops at bottom of burrow in joint	Standing	Alive after 2 days.
	Tests with Saturated Solution of Virginia-Carolina "Standard"		
2	Submerged	2	Died in 3½ hours, no feeding.
2	Food wet, then dried	....	Died in 2 hours, no feeding.
2	Same food as above	....	Died in 4 hours, slight feeding.
2	Submerged	5	Died in 1 hour, slight feeding on fresh food.
2	Submerged	10	Died in 30 minutes, no feeding.
3	Submerged	15	Died in 75 minutes, no feeding.
3	Floated on solution	½	Crawled out of solution, died in 50 minutes.
4	Food wet, then dried	....	Died in 40 minutes, no feeding.
4	Crawled on moist glass	¼	Died in 4 hours, no feeding.
5	Wet head only	....	Died in 4 hours, no feeding.
3	**Check:** Submerged; pure water	5	Alive, normal, after 4 days.
3	Submerged	1	Alive, normal, after 3 days.
5	Wet tail end only	....	Terminal prolegs contracted convulsively, recovered and fed normally 4 days.
5	Infested joint wet then blotted dry	....	Ceased feeding and formed cell—uninjured.
5	Submerged	1	Formed cell without feeding, alive after 3 days.
3	Wet tail end only	....	Alive, normal, after 4 days.
4	Floated, head submerged	1	Dried on blotter. Alive, normal, after 3 days.
3	One drop at bottom of burrow. Absorbed after ½ min.	½	Alive, normal, after 4 days.
4	Wet in burrow, 4 drops	....	Died without further feeding in 2 days.
3	Cotton plug only wet, left in vial	....	Alive, normal, after 4 days.
4	Cotton plug only wet, left in vial	....	Alive, normal, after 4 days.
3	3 drops in bottom of vial only	....	Died in 1 day, probably drank of solution.
3	3 drops in bottom of vial only	....	Alive, normal, after 4 days.
3	3 drops in bottom of vial only	....	Alive, normal, after 4 days.
4 3	Infested joint wet	2	Both died within 3 days.
3	Submerged, with cane	½	Died in 1 day, no feeding.
3	Submerged	¼	Alive and feeding after 3 days.
3	Submerged	¼	Alive and feeding after 3 days.
4	3 Drops on end of joint, larva untouched	....	Alive, normal, after 4 days.
4	Ditto	....	Alive, normal, after 4 days.
4	Floated and submerged	2½	Died in 19 hours.
4	Floated and submerged	2½	Alive, feeding after 3 days.
4	2 Drops on grass in mouth of burrow	....	Alive, normal, after 4 days.
4	Floated on side, head up 7 min., down 8 min.	15	Died in 2 days, no feeding.
3	Wet tail end only	1	Alive, normal, after 5 days.
3	Floated and submerged	10	Died within 2 days, no feeding.
3	One drop behind larva in burrow, head down	....	Alive, normal, feeding after 4 days.
3	Floated, not submerged	5	Died within 2 days; exudate at mouth.
4	3 Drops at burrow opening	....	Alive, normal, after 4 days.
4	2 Drops on larva in burrow	....	Died within 2 days.
5	Submerged	15	Died within 2 days, no feeding.
5	3 Drops ran over burrow opening	....	Died in 4 days, head end black.
2	One drop on edge of leaf roll	....	Larva escaped.

TABLE No. 11.—CONTINUED.

Tests with Saturated Solution of Jungmann's "Extra Light"

Stage of Larva	Nature of Treatment	Duration of Treatment Minutes	Remarks on Effects of Treatment
2	Submerged	1	Alive, normal, after 3 days.
4	Floated and crawled out	½	Alive, normal, after 3 days.
4	2 Drops on body, in burrow	......	Alive, normal, after 4 days.
3	Wet head only	1	Alive, escaped after 3 days.
3	4 Drops at lower end of cane joint	......	Alive after 1 day, but dead in vial after 3 da.
2	Wet tail end only	......	Died after 4 days, without feeding.
3	One drop held against body by brush	1	Alive, normal, after 3 days.
3	2 Drops in burrow	......	Alive, normal, after 3 days.
2	Submerged	5	Alive, feeding after 2 days.
3	Wet leaf roll slightly	......	Alive, normal, after 6 days.
3	Wet leaf roll slightly	......	Alive, normal, after 2 days, died in 4 days—no molt.
3	Submerged	5	Died within 2 days; exudate at mouth.
2	Stalk section submerged	5	Died in 2 days, no feeding, larva untreated.
3	Floated 5 min. and submerged	7	Died within one day, no feeding.

With reference to these observations it appears that where the borer larvae are killed through a poisonous dose taken into their stomachs there appears frequently at least a distinct exudate from the mouth. In many cases where the solution did not appear to reach the mouth at all but came in contact only with the posterior portion of the body, there was clearly evident a convulsive movement of the prolegs which gave assurance of a distinct and probably severe irritation. This might extend to paralysis and the ultimate death of the larva or in mild cases there might be a complete recovery with subsequent normal development of the larva. In many cases half-grown larvae died within a few hours without feeding when they were placed on sections of cane which had been submerged in the solution and then allowed to become air-dry before the larvae were placed thereon. It seems quite certain that there is a distinct contact killing effect with sugarcane borer larvae where sodium silicofluoride applications are made, and there is no doubt whatever as to the effect as a stomach poison whether the larva imbibes the poison solution or feeds upon tissue upon which solution has dried. There is also distinct evidence of a difference in toxicity to the borer between the solutions from various brands of sodium silicofluoride materials.

EFFECT OF SILICOFLUORIDE DUSTS ON HATCHING OF EGGS AND EMERGENCE OF PARASITES

A series of tests to determine the effect of silicofluoride dust upon the hatching of borer eggs was conducted in the Laboratory. A large number of sections of cane leaves bearing egg masses were fastened to a sheet of cardboard and heavily dusted with sodium silicofluoride dust. They were then kept under observation indoors where no dew formed. The eggs appeared to hatch entirely normally. The young larvae crawled only a short distance from their eggs, however, before the effect of the sodium silicofluoride dust became apparent. In one test 20 larvae hatching from a batch of eggs placed in the middle of a large sheet of glass and all dusted moderately heavy, all died within a radius of but little more than a foot from the point of hatching. Full-grown larvae, also placed at the center of a large sheet of glass which had been dusted, died within an hour from crawling less than a foot on dry dusted glass.

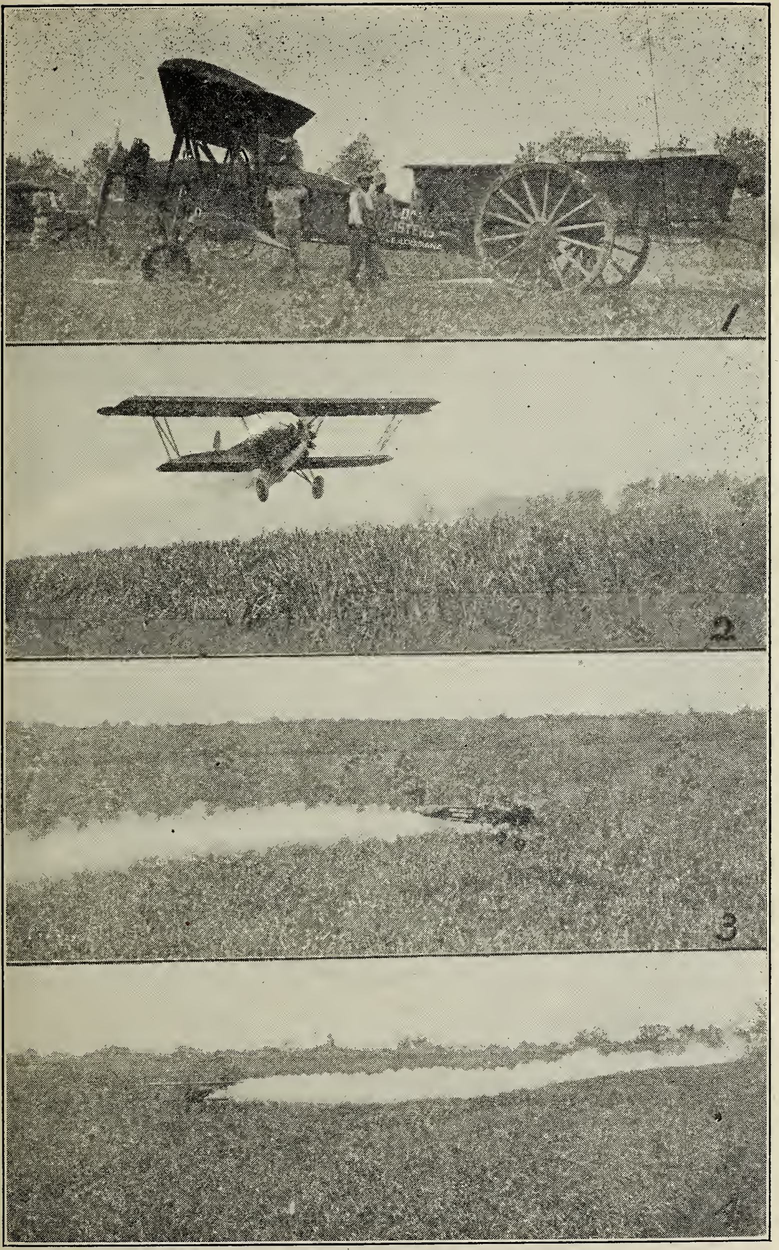
Observations made in the field also indicate that the applications of silicofluoride dust do not prevent the hatching of eggs of the cane borer.

To test the effect of silicofluoride upon the egg parasite, *Trichogramma minutum,* batches of parasitized eggs were immersed half way in a saturated solution of sodium silicofluoride (Wiarda's "Heavy") for from 1 to 5 minutes and then allowed to dry in the air. In all of these tests the parasites appeared to emerge normally and as though uninjured by the treatment. Some parasites were found dead unemerged but no evidence has yet been obtained to show that this mortality was not entirely natural or that it was not as great in untreated eggs as among those which had been treated. Here again field observations appear to confirm those made in the Laboratory and indicate that the dusting treatment for sugarcane fields will not interfere with the normal development and activity of the egg parasites. If further observations confirm the accuracy of this conclusion, it would appear that dust applications through the killing of larvae and a reduction in the number of eggs that may be deposited in succeeding generations should actually result in a higher percentage of parasitism where the dusting is practiced.

AIRPLANE DUSTING WORK OF 1926

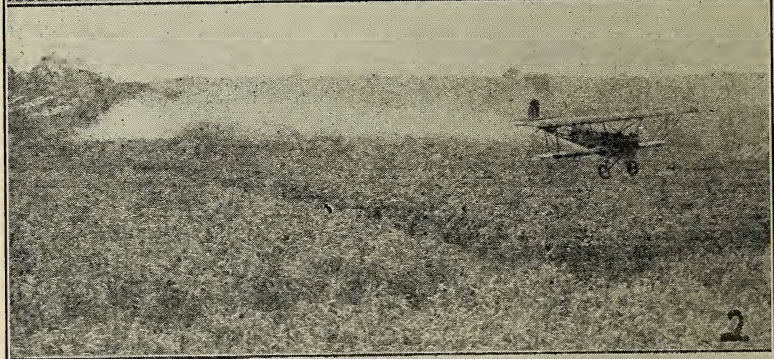
On account of the comparatively light borer infestation existing in cane up to the latter part of August, 1926, when on the average less than 10% of the cane stalks showed a borer burrow, all definite plans for extensive field work had to wait until very late in the season. The severe tropical storm of August 25, 1926, injured the cane severely but also had the effect of destroying large numbers of borer moths which happened then to be active and also destroyed practically all of the eggs and of the larvae less than half grown that occurred in the fields at the time of the storm. The larger larvae and pupae in the bases of the stalks were practically uninjured by the storm and moths were emerging the next night. By the second night eggs were being laid and the multiplication of borers from this time on became more rapid. However it was the last of September before conditions in the field were considered as justifying field applications of sodium silicofluoride.

Arrangements were then completed for cooperative experimental work whereby the grower bore the cost for poison used and the expense for its application was divided between the Experiment Station and the Huff Daland Dusters, Inc., who did the work. The application expense for such experimental work must necessarily be much higher than would be expected with ordinary commercial dusting operations after the experimental work has been completed. The fairest basis for pay in such work was thought to be at an agreed rate per minute for the time that the plane was actually flying. Such experimental work is likely to involve a large number of flights, many of which will carry only a small amount of poison and applications must be made to test the poundage or application rate per acre required to secure the most satisfactory control of the insect and in such work a plane and its staff is not likely to be kept in full time operation.



AIRPLANE OPERATIONS IN DUSTING SUGARCANE FOR BORER CONTROL

Plate III. Fig. 1, Loading airplane with poison at landing field; Figs. 2, 3 and 4, Three views of airplane in operation dusting sugarcane with sodium silicofluoride. Note height of plane and settling of dust cloud.



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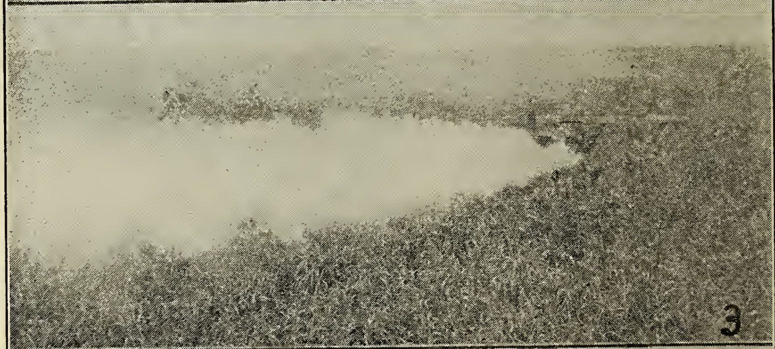

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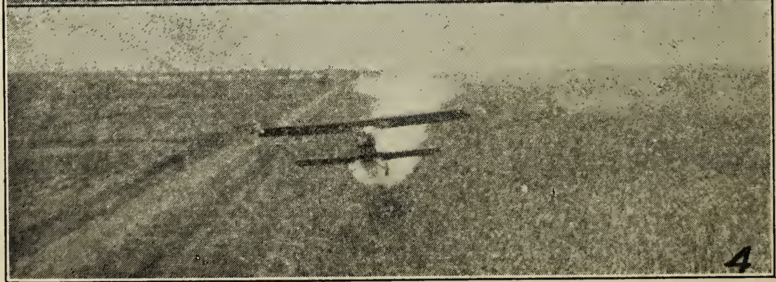

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CONTROL AND DISTRIBUTION OF DUST DISTRIBUTED BY AIRPLANES

Plate IV. Fig. 1, Airplane begins dusting at crossroad; Fig. 2, Dust placed accurately in corner of cut beside cabins; Fig. 3, Dust swaths overlap when placed about 100 feet apart; Fig. 4, Plane starting "zoom" at end of rows.

The airplane work in 1926 was located on the grounds of the Louisiana Sugar Experiment Station at Baton Rouge and on selected parts of six plantations belonging to A. Wilbert's Sons & Company at Plaquemine, Louisiana. The distance between the two locations was less than fifteen miles for the airplane and but little more by road. Thus the work could be handled conveniently from Baton Rouge as a center.

DETERMINATION OF POUNDAGE PER ACRE REQUIRED FOR BORER CONTROL

The first of these tests was applied on the morning of September 25 to cane at the Louisiana Experiment Station. As soon as possible after each application infested stalks were examined by cutting them up carefully to find the borer larvae living or dead and to determine the percentage killed by the application. In this work the time allowed before the examinations were made was much less than would ordinarily be given and the percentages of kill recorded are naturally very much less than would have occurred with a longer interval before the examination. However with the pressure for quick results it was considered that an interval of two or three days would give a fair indication as to whether the rate of application given was satisfactory. The principal results are shown in the following table:

TABLE No. 12. TESTS TO DETERMINE POUNDAGE REQUIRED FOR BORER CONTROL BY AIRPLANE DUSTING.

Lbs. Per Acre	Date Examined	Canes Examined	Larvae Alive	Larvae Dead	Per Cent Dead	Foliage Burning	Remarks
Test No. 18 Applied 9/25 at Experiment Station on 16 Acres, Without Dew.							
5	9/27	113	47	5	9.6	None	Dosage too light.
Test No. 19 Applied 9/27 at Experiment Station on 32 Acres, Without Dew.							
18	9/28	175	44	5	10.2	None	Too soon to get real kill.
	9/29	150	38	24	38.7	None	Better "kill" by 2nd day.
	9/30	181	28	40	58.8	Slight	Better "kill" by 3rd day.
	10/6	56	12	14	53.8	Slight	Still "killing" 9th day.
	10/13	200	58	12	17.1	Little	Still "killing" 16th day.
Test No. 20, Redusted on 9/28 at Experiment Station 16 Acres Used in Test No. 18, with Heavy Dew.							
10 (Total 15)	10/1-2	380	135	59	30.4	Slight	
	10/6	106	40	12	23	Moderate	Not very satisfactory.
Test No. 21 Applied 10/1 at Plaquemine on 300 Acres, Without Dew. Rain fell within 24 hours after Dust applied.							
11	10/4	200	183	61	24.5	Trace	Heavy rain 10/2.
	10/5	180	101	27	21.1	Slight	Dosage too light.

An examination of the Table indicates that only in Test No. 19 was the borer kill comparable with that obtained usually with standard dust material in hand gun applications as shown in Table No. 9 on page —. This shows what may be considered as a fairly satisfactory degree of mortality and indicates that an application of approximately 18, or more, pounds per acre is necessary in airplane applications. In such applications the dust is distributed quite evenly throughout the field and is not concentrated at the throat of the plant as is the case with hand gun applications. Therefore the amount of dust required is decidedly greater with airplanes to secure the degree of control obtained in hand gun work on corn. From these experiments a dosage of from 18 to 20 pounds per acre was determined upon as a standard application of sodium silicofluoride dust to cane by the airplanes used in 1926.

IS DUSTING WITH SODIUM SILICOFLUORIDE SAFE FOR SUGARCANE EYES?

Among all of the extensive applications of dust made to cane in 1925 and 1926, and in course of which all varieties of cane grown at the Louisiana Experiment Station were dusted, the most severe burning was experienced during the early applications at Baton Rouge when a dosage of 18 pounds of Jungmann's Extra Light Levosol was applied without any mixture with hydrated lime. It happened that this application was made at about 5:30 P. M. on September 27. The plants were entirely dry and conditions were excellent for dust distribution. A swath width of about 75 feet was used. The following morning, and each morning for a week thereafter, heavy fogs occurred and hung over the cane fields until about 8:30 A. M. It is certain that the chemical burn on sugarcane foliage was heavier on the plats at Baton Rouge than was experienced at Plaquemine with the same dust material applied at practically the same rate and on the same date. At Plaquemine the burning was negligible in all cases, even without the addition of lime.

At Baton Rouge there was a very evident difference in susceptibility to chemical burning in different varieties. The most seriously burned varieties were P. O. J. 228, and 979. The latter variety particularly suffered so severely that it was checked in growth and the upper joints were shortened thereby. Because of its evident tenderness, which was indicated first by severage breakage during the tropical storm of August 25, 1926 and again by the susceptibility to burning, this variety was selected for examination on a more extensive scale than any other to see whether the burning really injured the eyes to a serious extent. All previous examinations on native canes, P. O. J. 234, etc., had shown no chemical injury whatever to the eyes of dusted cane. The results on the two most severely burned varieties are shown in Table No. 13.

TABLE No. 13. EXAMINATIONS FOR INJURY TO EYES IN DUSTED CANE DUSTED SEPTEMBER 27, 1926, AT BATON ROUGE WITH 18 POUNDS PER ACRE OF JUNGMANN'S EXTRA LIGHT LEVOSOL, WITHOUT LIME. EXAMINED OCTOBER 16, 1926.

Variety	No. of Canes Examined	Results of Examinations of Eyes				
		Total Eyes Examined	Borer Damaged		Chemically Injured	
			No.	%	No.	%
P. O. J. 228	200	2048	42	2.	4	.2
P. O. J. 979	277	2672	49	1.8	25	.9

The foregoing records, together with the general observations made during two seasons, show clearly that the eyes of cane are reasonably safe from danger of injury by chemical burn so far as Jungmann's Extra Light Levosol is concerned, even without the use of lime which in small percentage serves to decrease the tendency to burn. None of the many other materials tested has thus far shown injury to the eyes but the most caustic of these materials have not been tested as yet upon the two most tender varieties of cane examined in Table No. 13. Such generally less desirable materials can be left out of the account, however, as we would not think of recommending them for general public use. The "standard treatment" for cane is entirely safe for the eyes.

The records show clearly that the damage being done by borers to the eyes of cane as shown in Table No. 13 was from two to ten times as great as that caused by chemical burn. This borer damage appeared to be checked decidedly by the treatment and there can be no question that, so far as planting cane was concerned, even these most tender varieties were decidedly benefited by the dust treatment in spite of the fact that their top growth was checked somewhat by the burning effect on the foliage.

BORER MORTALITY RESULTING FROM VARYING POUNDAGE OF "STANDARD DUST"

On October 7, 1926 at Plaquemine a series of applications was made under as nearly uniform conditions as possible to test the control obtained from applications of Jungmann's Extra Light Levosol with 10% lime (which had been adopted as our "Standard Dust" for 1926 field work) at rates of 5, 10, 15 and 20 pounds per acre. A total area of 26 acres was included in the four plats thus treated. The dust was applied between 5:00 and 5:30 p. m. when the plants were dry and the air drift was light. These conditions favored an even distribution of the dust. See Table No. 14 for results.

TABLE No. 14. BORER MORTALITY FROM VARYING POUNDAGE APPLICATIONS OF "STANDARD DUST" JUNGMANN'S EXTRA LIGHT LEVOSOL WITH 10% HYDRATED LIME. PLAQUEMINE, LA. DUSTED OCTOBER 7, 1926.

Test No.	Lbs. Per Acre	Examinations		Larvae Alive	Larvae Dead	Per Cent Dead	Foliage Burn
		Date	No. Canes				
23	5	10/11	40	17	9	34.2	Very slight
24	10	10/11	51	18	9	33.3	Slight
		10/12	45	9	18	66.7	Slight
		10/13	70	16	13	45.	Slight
		Totals......	166	43	40	48.	Average dead
25	15	10/11	50	15	13	47.	Slight
		10/12	99	31	9	22.5	Slight
		10/13	76	25	21	45.	Slight
		Totals......	225	71	43	37.7	Average dead
26	20	10/11	53	13	18	58.	Slight
		10/12	100	27	36	57.	Slight
		10/13	77	11	44	80.	Slight
		Totals......	230	51	98	65.8	Average dead

As a matter of fact these tests show a fairly consistent increase in borer mortality in proportion to the amount of dust applied. The kill with the 20 pound application was consistently higher and generally more satisfactory than with the lighter applications. This treatment showed approximately the same percentage of kill as occurred repeatedly with the best dusts in applications to borer-infested corn.

The burning of foliage was in all cases so slight that it would not likely be noticable at all to the grower. It appeared as a slight "edge burn" on the leaves with sometimes a small discolored area at the base of the leaf. The general color of foliage on the dusted plats could not be distinguished from that on undusted plats of the same variety of cane.

The conclusion drawn from these, and other tests bearing on this matter of dosage, was that our "standard dust" for field work with Jungmann's Extra Light Levosol should include 10% of hydrated lime to reduce leaf burning to a minimum and that an application of from 18 to 20 pounds per acre should be given. With such applications it was reasonable to expect the destruction of more than two-thirds of the borer larvae on or in the dusted cane.

BORER MORTALITY IN TOPS VS. BUTTS IN DUSTED CANE

Many preceding examinations in both corn and cane had indicated that borer larvae were killed fairly uniformly in tops and in butts but these records were based upon hand gun dusting and the distribution of the dust over the stalk could not be made as uniform as it is in airplane dusting work. Therefore an extensive series of examinations was made on cane dusted at Plaquemine from October 13 to 19, 1926. Sample lots of infested stalks cut at widely scattered points so as to secure a fair average of the dust application were examined from 5 to 11 days after the completion of the dusting. As a rule 100 stalks were examined each day for each dust and work on five plantations was tested in this way.

The dust applied consisted of Jungmann's "Extra Light" Levosol with 10% Hydrated Lime and a standard application of approximately 20 pounds per acre was given in each case. The stalks cut on these various plantations at Plaquemine were loaded in a truck and hauled about sixteen miles to the University at Baton Rouge where the examinations were made by student field assistants. It seems certain that in the course of this handling and hauling many of the dead younger borer stages particularly would inevitably have been jarred loose from the top leaves and have been lost, while practically all of the living stages would remain attached to the tops or protected entirely within the butt portions of stalks. In some cases the records were made on the entire stalks without distinguishing between tops and butts.

During the course of these tests no rains occurred and the entire effect in dissolving dusts and spreading the solution over the stalks may be attributed to dews.

The principal data from these examinations are shown in Table No. 15.

TABLE No. 15. BORER MORTALITY IN TOPS VS. BUTTS OF DUSTED CANE PLAQUEMINE, LA.—OCTOBER 13 TO 29, 1926.

Interval, Days*	No. Canes Examined	Larval Stages								
		In Tops			In Butts			Entire Stalk		
		Alive	Dead	% Dead	Alive	Dead	% Dead	Alive	Dead	% Dead
5	50	....	....	....	....	....	....	11	4	26.6
5	100	....	....	....	....	....	....	25	23	47.9
4	100	....	....	....	....	....	....	47	17	26.5
5	100	....	....	....	....	....	....	55	36	39.5
6	100	42	45	51.7	11	2	15.	53	47	47.
11	100	28	29	50.8	12	5	29.4	40	34	45.9
3	100	....	....	....	....	....	....	57	28	33.
4	100	....	....	....	....	....	....	101	43	30.
5	100	....	....	....	....	....	....	92	31	25.2
6	100	39	26	40.	9	2	18.1	48	28	36.8
4	100	11	9	45.	37	8	17.8	48	17	26.1
11	100	13	10	43.5	71	41	36.6	84	51	37.7
6	100	7	5	41.6	14	4	22.2	21	9	30.
8	100	9	7	43.7	15	7	31.8	24	14	36.8
Totals	1350	149	131	46.8	169	69	29.	706	382	35.1

(*Number of days intervening between dust application and examinations.)

From the foregoing figures it appears that the average percentage of kill among borer stages in the tops of the stalks was considerably higher than among the larger stages burrowing in the butts of the stalks. This was the condition occurring without rains following the application of our "standard dust," including lime.

For comparison with these records without rains, another series shows the results from smaller scale applications of three brands of commercial sodium silicofluoride used without lime. The burning effect on foliage in this series was considerably greater than in the preceding series. The applications were made on October 20 and the examinations followed in from 5 to 8 days. The texture of the materials varied so greatly that the poundage could not be adjusted uniformly on these small applications but ranged from 15 to 20 pounds per acre. The three brands tested in this series were supplied by Mr. Aubrey Bartlett, New Orleans and by The Grasselli Chemical Company and The Virginia-Carolina Chemical Company, and the records for each brand are given in this order.

With this series of tests light showers followed the applications with a total rainfall of more than one inch.

TABLE No. 16. BORER MORTALITY IN TOPS VS. BUTTS OF CANE DUSTED WITH THREE BRANDS OF COMMERCIAL SODIUM SILICOFLUORIDE, WITHOUT LIME. PLAQUEMINE, LA.—OCTOBER 20 TO 28, 1926.

Interval, Days	No. Canes Examined	Larval Stages								
		In Tops			In Butts			Entire Stalk		
		Alive	Dead	% Dead	Alive	Dead	% Dead	Alive	Dead	% Dead
(Bartlett's Sodium Silicofluoride)										
6	100	12	3	20.	20	10	33.3	32	13	28.8
8	100	10	32	76.2	13	15	53.5	23	47	67.1
Totals	200	22	35	61.4	33	25	43.1	55	60	52.1
(Grasselli's Sodium Silicofluoride)										
5	100	5	8	61.5	19	30	61.2	24	38	61.2
7	100	16	10	38.4	32	12	27.2	48	22	31.4
Totals	200	21	18	46.1	51	42	45.1	72	60	45.3
(Virginia-Carolina's Sodium Silicofluoride)										
6	100	15	6	28.5	17	4	19.	32	10	23.8
8	100	14	13	48.1	10	2	16.6	24	15	38.4
Totals	200	29	19	39.6	27	6	18.1	56	25	30.8

Taking an average of the results from these three dusts we would find 50% of the larvae dead in the tops, 42% in the butts and 44.2% average for the entire stalks. These figures are about 9% higher than the average secured as shown in Table No. 15. The principal part of this difference comes in the higher percentage of killing found in the butts of the stalks reported in Table No. 16. Undoubtedly part of this greater toxicity was due to the use of undiluted commercial materials containing no lime, and it is quite possible also that part of the increase shown in this second series was due to the occurrence of showers which helped to dissolve the materials and spread them more fully.

INFLUENCE OF DUSTING UPON PERCENTAGE OF JOINTS BORED IN DUSTED VS. UNDUSTED P. O. J. VARIETIES AT SUGAR EXPERIMENT STATION, BATON ROUGE

In these tests an application of 18 pounds per acre of Jungmann's "Extra Light" Levosol without Lime was given on the evening of September 27 when there was no dew on the plants. The examination period ranged from November 17 to 26. During this interval there was time for the next generation of borers to develop and enter the lower joints of the cane. The canes as examined represented the matured portion which would be cut for the mill or used in planting. The figures showing the number of joints bored show the accumulation of borer burrows throughout the season. There is plainly a difference in the degree of infestation in different varieties. Unfortunately it was not possible to have an undusted check area of each variety and only P. O. J. 234 could be examined as an undusted check area. The number of stalks examined in this check is small but the comparison may give a fair indication as to whether the application of dust decreased perceptibly the percentage of stalks showing borer burrows and the percentage of joints infested by borers.

TABLE No. 17. INFLUENCE OF ONE DUST APPLICATION UPON BORER INFESTATION IN P. O. J. VARIETIES. SUGAR EXPERIMENT STATION, BATON ROUGE, LA.

P. O. J. Variety	No. Canes Examined	% of Canes Bored	Total No. Joints	Total Joints Bored	% Joints Bored
213	100	56.	1319	108	8.1
36	100	47.	1561	73	3.3
826	200	65.	2660	255	9.5
2379	100	47.	1152	99	8.5
979	200	62.	2039	241	11.3
2379	200	84.	2531	377	15.
1228	199	80.5	3398	408	12.3
Totals	1099	61.6	14660	1561	10.8
P. O. J. 234 Undusted. (Not considered as an adequate check.)					
234	100	83.	1312	213	16.2

On account of their value for seed, no P. O. J. canes could be destroyed by cutting them up for the complete examinations which were made with native canes.

TIME REQUIRED TO REACH THE PEAK OF MORTALITY

During the course of this work examinations were made all the way from 1 to 16 days after the dust was applied to determine the percentage of larvae found dead at that time. Naturally the mortality must accumulate and increase steadily for several days before it reaches the "peak" point. Thereafter the mortality percentage is likely to decline rather gradually but continuously until the toxicity ceases, as it must ultimately cease through the dilution of solutions, the removal of poison from the plant and the formation of new growth in the tops.

In poisoning work it is desirable, of course, to kill the borers while they are yet young and feeding in the leaf roll and thus prevent the later formation of a burrow into the stalk which becomes a permanent injury. The feeding work on the leaves probably has no appreciable effect upon the growth of the cane or the formation of sugar until after the larvae had reached the third stage in their growth. They may then burrow into the mid-ribs of the leaves and as a result many of the leaves will break down at these weakened points. From the third stage on the burrowing into the stalk becomes their regular habit and this is, of course, a permanent type of injury which will reduce tonnage and sucrose directly. Therefore the killing of larvae in the first and second stages is highly important in preventing damage to cane.

There is very little natural mortality among the borers after they reach the fourth and fifth stages. The killing of these larvae in their burrows checks further damage by them but even more important than this it decreases directly the number of adults to issue from that generation and to multiply injury during succeeding generations.

It is of interest therefore to study rather in detail the percentage of mortality occurring in each stage of larval growth as well as the average among all stages for each day following the dust application. This information is presented in Table No. 18.

TABLE No. 18. PEAK OF MORTALITY FOLLOWING DUST APPLICATIONS, OCTOBER, 1926. DUSTS USED INCLUDED JUNGMANN'S "EXTRA LIGHT" ALONE AND WITH 10% HYDRATED LIME, ALSO BARTLETT'S, GRASSELLI'S AND VIRGINIA-CAROLINA MATERIALS. RECORDS TAKEN FROM FORTY-FOUR APPLICATIONS ON SEVEN PLANTATIONS, BATON ROUGE AND PLAQUEMINE.

Days After Dusting	Lbs. Per Acre	1st Stage		2nd Stage		3rd Stage		4th Stage		5th Stage		All Stages	
		Total No.	% Dead	Total No.	% Dead	Total No.	% Dead	Total No.	% Dead	Total No.	% Dead	Total No.	% Dead
1	18	0	0.	0	0.	3	0.	20	10.	26	11.5	49	10.2
2	5	5	0.	11	9.	4	25.	7	0.	25	12.	52	9.6
	18	0	0.	10	90.	1	100.	2	50.	15	6.7	28	42.8
	Totals......	5	0.	21	47.6	5	40.	9	11.1	40	10.	80	21.2
3	18	0	0.	24	83.3	9	77.7	21	9.5	32	34.3	86	46.5
	10	15	66.7	20	55.	12	33.3	21	14.3	36	16.7	104	32.7
	11	18	61.1	43	44.1	70	24.2	46	17.3	67	8.9	244	25.
	20	14	78.5	13	61.5	18	38.9	8	12.5	32	3.	85	33.
	Totals......	47	68.	100	58.	109	32.1	96	14.5	167	14.5	519	31.4
4	5	9	11.1	3	33.3	3	66.6	1	0.	10	0.	26	34.6
	10	28	64.3	7	42.8	14	14.2	7	14.2	34	3.	90	27.7
	10	6	66.7	5	20.	5	20.	6	0.	5	60.	27	33.3
	11	18	72.2	15	40.	17	11.7	29	17.2	49	2.	128	21.
	15	7	71.4	5	60.	5	60.	3	0.	8	25.	28	46.4
	18	1	100.	2	100.	7	100.	3	33.3	3	33.3	16	75.
	20	3	100.	9	77.7	5	40.	8	50.	6	33.3	31	58.
	20	9	78.	12	75.	15	26.7	6	0.	22	13.6	64	26.5
	20	10	80.	17	52.9	39	46.	31	22.5	47	2.1	144	30.
	20	6	66.7	6	50.	11	45.4	19	15.8	23	8.7	65	26.1
	Totals......	97	72.1	81	45.7	121	41.4	113	18.5	207	7.2	619	30.6
5	10	3	100.	2	50.	3	0.	4	0.	3	0.	15	26.7
	11	16	81.2	2	0.	4	50.	1	100.	4	50.	27	66.7
	15	1	100.	4	25.	12	16.7	7	28.5	16	18.7	40	22.5
	15	4	100.	4	75.	17	81.1	18	77.7	19	10.5	62	61.2
	18	11	90.9	6	33.3	15	46.6	7	28.5	9	22.2	48	47.7
	20	15	73.3	10	90.	13	61.5	16	43.1	9	11.1	63	57.1
	20	20	90.	6	66.7	7	71.5	16	25.	41	9.7	90	38.8
	20	11	63.5	16	68.7	17	41.	25	16.	54	4.	123	25.2
	Totals......	81	82.7	50	62.	88	52.2	94	31.9	155	10.2	468	41.4
6	10	7	100.	2	50.	3	66.7	1	0.	16	18.7	29	44.8
	12	2	50.	9	44.4	8	12.5	10	30.	13	7.6	42	26.1
	15	8	87.5	8	50.	9	0.	8	25.	12	0.	45	28.8
	15	17	58.8	1	0.	14	50.	2	0.	12	33.3	46	45.6
	20	14	100.	20	85.	5	100.	4	50.	12	50.	55	80.
	20	16	75.	12	91.6	15	53.3	11	45.5	46	23.9	100	47.
	20	7	86.	11	54.5	15	40.	20	30.	23	17.4	76	36.8
	20	2	100.	2	100.	3	100.	6	0.	17	11.7	30	30.
	Totals......	73	80.8	65	69.2	72	44.4	62	29.	151	20.5	423	43.7

TABLE No. 18.—CONTINUED.

Days After Dusting	Lbs. Per Acre	1st Stage		2nd Stage		3rd Stage		4th Stage		5th Stage		All Stages	
		Total No.	% Dead	Total No.	% Dead	Total No.	% Dead	Total No.	% Dead	Total No.	% Dead	Total No.	% Dead
7	15	6	100.	6	33.3	14	35.7	19	21.	25	20.	70	31.4
8	10	8	50.	3	33.3	12	16.7	9	11.1	20	20.	52	23.
	12	3	100.	5	40.	5	80.	6	33.3	20	20.	39	38.4
	15	18	100.	1	100.	17	70.5	13	61.5	21	38.	70	67.1
	20	6	100.	3	100.	6	33.3	5	20.	18	11.1	38	36.8
	Totals......	35	88.5	12	58.3	40	50.	33	36.3	79	22.7	199	44.2
9	11	18	66.7	14	42.8	46	13.	31	16.1	107	9.3	216	18.
	18	16	75.	0	0.	1	0.	0	0.	9	22.2	26	53.8
	Totals......	34	70.5	14	42.8	47	12.7	31	16.1	116	10.3	242	21.9
10	20	3	0.	15	33.3	12	50.	23	4.3	90	3.3	143	10.5
11	20	23	60.8	6	66.7	14	42.8	8	37.5	23	30.4	74	45.9
	20	3	100.	6	100.	17	52.9	36	33.3	73	28.7	135	37.7
	Totals......	26	65.3	12	83.3	31	48.3	44	34.	96	29.2	209	40.5
16	18	18	33.3	1	0.	9	11.1	19	21.	23	4.3	70	17.1

With reference to Table No. 18 it should be noted first that it includes records from the use of a good many different materials and with the poundage rate running from 5 to 20 pounds per acre. Therefore many of the treatments studied would not be considered as satisfactory for general field use. However the peak of mortality would not be affected greatly thereby, although the total mortality resulting from the treatment might vary greatly.

The distribution of the figures shows the percentage of mortality occurring with each of the five usual sizes or stages occurring in the larval period and the last two columns show the total number of larvae found in each examination and the average percentage of all sizes of larvae found dead. The most significant figure with each period of examination is the final percentage figure show-

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ing the average percentage of larvae dead with all of the treatments examined for each day after the dust was applied. These results may be shown more clearly by bringing together simply the mortality percentage figures found as a result of all examinations made with each stage and for each day after the dust was applied.

TABLE No. 19. COMPARISON OF AVERAGE MORTALITY PERCENTAGES FOR EACH LARVAL STAGE AND FOR EACH DAY AFTER DUSTING, TO SHOW PEAK OF MORTALITY.

Days After Dusting	No. of Exams.	Avg. Lbs. Per A.	Average Percentage of Larvae Found Dead, By Stages					
			1st %	2nd %	3rd %	4th %	5th %	All Stages %
1	1	18	....	....	0.	10.	11.5	10.2
2	2	11.5	0.	47.6	40.	11.1	10.	21.2
3	4	15	68.	58.	32.1	14.5	14.5	31.4
4	10	15	72.1	45.7	41.4	18.5	7.2	30.6
5	8	16	82.7	62.	52.2	31.9	10.2	41.4
6	8	16.5	80.8	69.2	44.4	29.	20.5	43.7
7	1	15	100.	33.3	35.7	21.	20.	31.4
8	4	14.75	88.5	58.3	50.	36.3	22.7	44.2
9	2	14.5	70.5	42.8	12.7	16.1	10.3	21.9
10	1	20	0.	33.3	50.	4.3	3.3	10.5
11	2	20	65.3	83.3	48.3	34.	29.2	40.5
16	1	18	33.3	0.	11.1	21.	4.3	17.1

It is quite evident from the table preceding that the peak of mortality may be found from the fifth to the eighth days after a dust is applied. The total mortality occurring is strongly influenced by the amount of dust applied. For example, in the examinations made on the fourth day the average mortality from applications of from 5 to 11 pounds of dust per acre (an average of 9 pounds) gave an average mortality of 25.15%. On the same day, with applications of from 15 to 20 pounds (average 19 pounds) gave a total average mortality of 43.7% among all stages of larvae.

The figures for the sixth day examinations are really most representative as they include five tests made with our "standard dust" and also three tests of commercial materials without the addition to lime. With our "standard dust" applications and a poundage ranging from 10 to 20 pounds per acre, the five tests examined on the sixth day showed a mortality of 53.1% of larvae of all sizes. An average of the three dusts (all "standard") examined on the tenth and eleventh days showed a mortality of 28.4%.

RELATIONSHIP OF POUNDAGE TO MAXIMUM MORTALITY AMONG LARVAE

In the following study of the data secured from nineteen applications which include quite a variety of dusts, we have arranged the data in the order of poundage applied to see particularly whether there is a distinct difference in results from applications made at the rate of less than 15 pounds per acre as compared with those ranging from 15 to 20 pounds per acre. See Table No. 20.

TABLE No. 20. RELATIONSHIP BETWEEN POUNDAGE AND MAXIMUM MORTALITY.

Test No.	Lbs. Per Acre	Days After Dusting	Locality	Material Used	Borer Stages		
					Alive No.	Dead No.	Dead %
18	5	2	Sugar Station	Jungmann's "Extra Light"	47	5	9.6
23	5	4	Milly Pltn.	J. "Ex. Lt." and 10% H. L.	17	9	34.6
20	10	3	Sugar Station	Jungmann's "Extra Light"	70	34	32.7
27	10	5	Crescent Pltn.	J. "Ex. Lt." and 10% Flour	11	4	26.
21	11	3	Myrtle Grove	Jungmann's "Extra Light"	101	27	21.
24	11	5	Milly Pltn.	J. "Ex. Lt." and 10% H. L.	9	18	66.7
22	11	9	Village Pltn.	Jungmann's "Extra Light"	177	39	18.
40	12	8	Milly Pltn.	Virginia-Carolina	24	15	38.4
Totals	9.4	4.9			456	151	24.9
39	15	5	Milly Pltn.	Grasselli's	24	38	61.2
25	15	6	Milly Pltn.	J. "Ex. Lt." and 10% H. L.	25	21	45.6
38	15	8	Milly Pltn.	Bartlett's	23	47	67.1
19	18	3	Sugar Station	Jungmann's "Extra Light"	46	40	46.5
28	18	5	Crescent Pltn	J. "Ex. Lt." and 10% Flour	25	23	47.7
34	20	6	Hunters Lodge	J. "Ex. Lt." and 10% H. L.	48	28	36.8
26	20	6	Milly Pltn.	J. "Ex. Lt." and 10% H. L.	11	44	80.
37	20	8	Milly Pltn.	Jungmann's "Light"	24	14	36.8
42	20	10	*Village Pltn.	J. "Ex. Lt." and 10% H. L.	128	15	10.5
35	20	11	Enterprise Plantation	J. "Ex. Lt." and 10% H. L.	84	51	37.7
33	20	11	Myrtle Grove	J. "Ex. Lt." and 10% H. L.	40	34	45.9
Totals	18.3	7.2			478	355	42.6

*The mortality shown in this test is so low as to lead to the suspicion that the sample taken was not representative.

In comparing the two sections of Table No. 20 it appears that in the second section with nearly double the amount of dust applied per acre, and with 2.3 days longer average interval before the examinations were made, there was an increase of 17.7% in the average total mortality found.

This increase in mortality from higher rates of application would appear to justify the expense for making the heavier application. In Tables No. 18 and No. 19 it was shown that the peak of mortality is reached in examinations made from the fifth to the eighth days after the dust is applied. If we compare only the examinations made within these limits, it appears that with the lighter applications at an average of 11 pounds per acre, and examinations made on the sixth day, there was an average of 43.7% mortality. With the heavier applications there was an average of 17.6 pounds applied on the seven tests recorded and examinations made in 6.3 days show an average of slightly over 53% mortality.

A close study of all the records presented in Tables No. 18 to No. 20 inclusive leads us to the conviction that applications of from 15 to 20 pounds of sodium silicofluoride per acre are advisable. The heavier dosage gives a higher percentage of kill among all sizes of larvae and also appears to maintain a fair rate of killing for a longer period than do applications of less than 15 pounds per acre. The cost for application is increased but slightly on account of the heavier application while the cost for materials is directly proportional to the poundage used.

Final Records for Season Based Upon Percentage of Joints Bored

The ultimate effect of any insecticidal treatment for the control of cane borer cannot be determined until the end of the season arrives. Then when borer multiplication has practically ceased and the final fall generation has had time to bore into the stalks where they will normally pass the winter, and the cane is ready for the mill, it is possible to make a final record upon borer infestation which is very definite. In these examinations the tops are discarded entirely and the attention is given to that portion of the stalk which would normally go to the mill or be used in planting.

We believe that the most definite and reliable basis for records on borer infestation at the end of the season consists in an actual count of the number of joints in each cane examined and a record also of the number showing borer burrows. If a joint shows several burrows, it is counted only as an infested joint and if a joint shows no external sign of borer attack it is counted as uninfested. From cutting open and examining thoroughly many thousands of stalks of cane we know that it often happens that young borers have made their initial burrow into a joint at a recent date and yet have done very little damage thereto. On the other hand, some of the larger larvae particularly may burrow through the node and thus cause damage to two joints although only one burrow is apparent on the exterior. These two considerations offset each other fairly closely and thereby serve to increase in considerable measure the accuracy of the indications as to borer damage in cane as shown by a record of the percentage of joints showing borer burrows.

In addition to the preceding record, a careful count has been kept of the number and size of the borer stages taken in cutting up thousands of stalks. As the number of stages found is usually less than the number of stalks examined, it has seemed best to express the "borer population" in terms of the number of stages found per 100 stalks examined.

In order to determine reliably the effect of the single dust application given on the major part of the nearly 1300 acres treated in the fall of 1926, with all kinds of dusts tested, and with varying poundage, etc., it was necessary to study likewise for the percentage of joint infestation and for borer population, a good many representative lots of undusted cane which might fairly be considered as a check on the experiment. In the dusting work a deliberate attempt had been made to dust the heaviest borer infested areas. Infestation records had been made in a very large number of areas before the dusting was begun and served as a guide in locating these areas of heaviest infestation. It is impossible to include in this publication the vast mass of records accumulated on the subject of borer infestation. It may be sufficient to state here that the check areas examined in connection with our dusting work were selected with exceptional care to insure their being comparable in all respects with the dusted areas of cane. Particular care was taken to insure uniformity as to variety, date of planting, stand, cultural conditions, growth and exposure to borer infestation, etc.

The final records were made from November 18 to December 11, 1926. This was from six to eight weeks after the dust was applied. During this interval the fourth generation borers had become mature and those that escaped destruction by the dusting had laid their eggs for the fifth generation. The work of this generation was very evident in the tops of the cane. The infestation was then much heavier than it had been before during the season, and most of these larvae had reached third stage at least and burrowed into the stalk so that their entrance holes could be counted in addition to all of those which had been accumlating from the attack of the preceding four generations throughout the season.

Our special acknowledgments are due to Messrs. A. Wilbert's Sons & Company for their generous permission to remove for these examinations the large amount of cane required. This cane had to be hauled to Baton Rouge where it could be examined carefully by our group of student Field Assistants who could work only during the afternoons that they could spare from their University duties.

A brief summary statement of the most important records from this extensive work is presented in Table No. 21. These records are grouped according to the variety of cane.

TABLE No. 21. FINAL RESULTS FROM ONE AIRPLANE APPLICATION OF SODIUM SILICOFLUORIDE, BATON ROUGE AND PLAQUEMINE, LA., SEPTEMBER 25 TO DECEMBER 10, 1926.

Variety	Treatment	No. Canes Examined	No. Joints Examined	Borer Stages per 100 Canes	Borer Infestation	
					Canes %	Joints %
Purple	None	569	8,787	82.4	95.4	23.8
	Dusted	793	12,831	45.5	78.4	12.6
Striped	None	197	2,702	69.	97.9	27.4
	Dusted	593	8,759	36.8	69.4	10.2
D-74	None	200	2,146	76.5	91.5	28.7
	Dusted	682	7,461	39.2	63.9	13.2
D-95	None	200	2,277	96.	98.5	32.6
	Dusted	190	1,906	60.	67.8	13.4
Totals	None	1,166	15,912	80.9	95.7	26.2
	Dusted	2,258	30,957	45.4	70.8	12.1

A study of the records in Table No. 21 shows that there is a very convincing "consistency" in the figures with all varieties of cane examined. In every case where any large number of stalks was examined, there was a decided reduction in the dusted areas in the number of borer stages per 100 canes, in the percentage of canes showing one or more borer burrows and particularly also in the percentage of joints which had been bored.

Naturally the larger the number of observations the more reliable will be the conclusions drawn therefrom. The examination of the 1166 stalks of undusted cane should certainly be sufficient basis for securing a very reliable average figure for borer population and infestation percentages. The inclusion of four different varieties in both the undusted check and the dusted cane examinations decreases further the likelihood of any important factor of error being included on account of varying degrees of borer attack in different varieties. Furthermore the examination of canes includes both dusted and undusted canes taken from each of the seven plantations on which treatments were applied. The figures show clearly the control effect on the borer resulting from a single application of poison. In the large majority of cases this treatment consisted of but one type of dust, (Jungmann's "Extra Light" Levosol) used either alone or with 10% of hydrated lime added. The applications were all made by one plane and pilot supplied by the Huff Daland Dusters, Inc. During the dusting period there was a fairly normal range of climatic conditions with rain on four days and with a total rainfall of more than 3 inches during the period when dust was being applied.

It would seem therefore that the degree of control effect on the borer shown in Table No. 21 is an unusually reliable indication of what may be expected in future work with the same materials and method of application. The examination of 2258 dusted canes showed that there was no significant or appreciable decrease in growth on account of the dusting. The borer population per 100 canes six weeks after the dusting was but 56% of that in the undusted check area. Only 74% of the percentage of canes bored in the undusted areas showed burrows where dust had been applied. Finally, the most significant and dependable figure of all is shown in the comparison of the percentages of joints bored in the undusted and dusted cane. This shows that the percentage of bored joints (12.1%) in the dusted areas was less than half that occurring (26.2%) in the undusted check cane. We believe that the actual benefit from insecticidal applications, or from any other type of borer control work, is shown most clearly and reliably through the percentage of infested joints occurring at the end of the season.

SUMMARY OF AIRPLANE DUSTING OPERATIONS, 1926

There are many important points to be considered in the actual flying operations, and which are entirely unrelated to insecticidal effects, in determining the practicability of the use of airplanes in sugarcane borer control. Only some of the most important points may be mentioned here in order that they made receive due consideration in the future development of commercial airplane dusting for borer control.

The matter of suitable and convenient landing fields for the planes is very important. This provides safety for the pilot and his machine and the distance from the field to the point of application of the poison has very much to do with the proportion of time that is necessarily wasted in travel for reloading. The carrying capacity of the plane depends very largely upon the power of its engine, the size and construction of the wings and of the dust hopper. The larger the dust-carrying capacity the more acres can be treated at a flight without reloading and the smaller the proportional time wasted in the operation of reloading. The power of the motor and the speed of the plane during dust distribution has much to do also with the fineness of separation of the dust particles, the evenness of the dust cloud and the uniformity of "effective coverage" through the dust swath. This also affects materially the proportion of the dust material that is practically wasted, or which may contribute to burning effects, through being thrown out in the form of small pellets or lumps instead of being broken up and distributed evenly in the dust cloud. It is also true that the method of agitation of the dust in the hopper must be such as to insure its being proportional to the speed at which the plane is flying if uniformity in the rate of dust distribution is to be maintained at all speeds of the plane. The method of control over the discharge of dust should be so quick and positive in its operation that the dust cloud may be placed very accurately where it is needed, with practically no wastage of poison and with no "dumping" of materials in excessive amount at any point. It is important also that the planes be of such construction that they are extremely sensitive and "maneuverable" so that they may be able to treat small areas, difficult places and to avoid obstructions quickly, and to make quick turns at the ends of swaths. The type of landing gear is also important as it may have much to do with the possibility of using many landing fields and particularly in increasing the safety to the pilot and machine in case forced landings under difficult conditions become necessary.

Most of the foregoing points have been thoroughly studied by Mr. B. R. Coad and his assistants at the U. S. Bureau of Entomology, Delta Boll Weevil Laboratory at Tallulah, Louisiana. The Huff-Daland Company attempted to incorporate all of the then known desirable features into the planes which they built especially for insecticidal work and one of these machines was used in the work referred to in this Bulletin. Our observations therefore apply only to this particular type of plane and might not apply to many others which are commercial or army types of planes which have been adapted as best they could be for the purpose of distributing insecticidal dusts.

The Huff Daland dusting plane used in our work had a wing spread of about 33 feet. The engine was of the Wright Whirlwind Type with 220 H. P. The lifting capacity of the plane was sufficient to take off easily from average landing fields with a gasoline supply sufficient for about four hours of flying and with a dust load capacity of from 600 to 700 pounds with the sodium silicofluoride dust used. In actual practice it was found convenient to use loads of 600 pounds as this represented the contents of 2 barrels of the dust as it was shipped by the manufacturer. This dust load was sufficient to treat from 30 to 40 acres of cane depending upon the actual rate of distribution ranging between 20 to 15 pounds per acre which was considered as being the allowable range in poundage.

SWATH WIDTH

This is an exceedingly important point in insecticidal dust applications by any type of machine. It becomes necessary to study it more carefully as the capacity of the machine increases so that it may cover a good many rows with each swath. In field operation the pilot usually lays down a short test swath to learn from it the direction of the air drift and the width of spread of the dust cloud. He then starts dusting across the line of this air drift and on the edge of the field away from it so that in laying down succeeding swaths he does not have to fly back and forth through the dust. The actual width of the dust swath used must depend upon a number of variable factors. The objective is to cover the cane as uniformly as possible with the dust at a poundage rate which has been determined by previous careful investigation as being "effective" for the control of the borers and "safe" for the cane.

In our 1926 work it was clearly apparent that the effective dust swath varied largely with the physical properties of the different dusts, with the rate of air movement across the dust swath, and with the height at which the plane flew above the cane. Some types of materials would not give an effective swath width of more than 50 feet under the same air conditions with which other dust materials would cover 100 feet. The most desirable height for flight with the machine and dust used appeared to be between 15 and 20 feet above the ground, or between 5 and 10 feet above the tops of the cane leaves. The dust swaths should be spaced at such distance apart that the thin edge of one will overlap the thick edge of the preceding swath. Care must be taken to see that the physical, dusting properties of the different ingredients in the dust used are not so widely different that the effective insecticidal particles settle quickly in the first part of the swath while the inert and ineffective dust "filler" or "carrier," or "neutralizer" (such as hydrated lime) which is much lighter in density than the sodium silicofluoride, give the appearance of covering a much wider area than is actually covered "effectively" for borer control.

With Jungmann's "Extra Light" Levosol the dusting properties were fairly good and the width of "effective dust swath" ranged from about 75 to 120 feet. Under fairly favorable atmospheric conditions, a swath width of 100 feet is possible. This will cover about 17 rows of cane planted at average distance apart. At this width the plane had to fly about 2½ miles while discharging dust to cover 30 acres of cane with an application at the rate of 20 pounds of dust per acre. If the dusting rate is reduced to 15 pounds per acre, the plane would cover 40 acres while discharging dust through a distance of 3.3 miles.

TIME REQUIRED TO DISCHARGE A LOAD OF DUST

With a dust load of 600 pounds the speed of the plane across the field was approximately 1½ miles per minute. It required, therefore, less than 2 minutes of actual dusting time to discharge the load at the rate of 20 pounds per acre and treat 30 acres of cane. At the rate of 15 pounds per acre it would require somewhat more than 2 minutes of flying time to discharge the load if the work could be continuous. This means an actual time requirement of 102 seconds to treat 30 acres at 20 pounds per acre and 132 seconds to treat 40 acres at 15 pounds per acre.

It is quite apparent, therefore, that the principal factor of cost in applying this dust is in the proportion of time required in turns between swaths and in returning to the landing field to reload poison. As an average estimate, we believe that less than one-sixth of the time required in discharging a load of dust is actually spent in the dusting operation. If this be approximately true, then the load capacity of the plane becomes an exceedingly important factor in economical work. The smaller the machine the more frequently it must reload and five-sixths, or more of its time, is spent in that operation. This is an important consideration in determining the relative economy of bids for commercial dusting work whether they are made on the basis (1) of acres dusted at a specified rate, or (2) of time consumed in actual flight or (3) of pounds of poison distributed at a specified rate per acre-application. Therefore the capacity of the plane, the rate of application per acre, the size of fields to be dusted, the concentration of acreage in large continuous areas and the convenient location of landing fields are all very important factors in determining what is a fair cost for the application of dust to sugarcane or other crops.

In our field operations in 1926 five loads of dust were put out in an hour repeatedly. This meant the application of 3,000 pounds of poison and the treatment of about 175 acres of cane on the average for one hour's work, with a landing field located between 4 and 5 miles distant. Of course this rate of treatment could not apply to our entire work. However the average flying time per load in our entire work was approximately 9 minutes. This did not include the time required in filling the hopper with poison.

GENERAL SUMMARY OF AIRPLANE DUSTING OPERATIONS LOUISIANA EXPERIMENT STATION—1926

Airplane used, Huff Daland Dusters, Inc., Monroe, Louisiana. Airplane Horse Power 220; Dust-hopper capacity 600 to 700 pounds, Pilot M. L. Alexander.

Location. Louisiana Sugar Experiment Station, Baton Rouge (indicated by B. R.)

A. Wilbert's Sons & Company, Plaquemine (indicated by Pl.)

Cross Country Flights between locations (indicated by X-C).

Time of Day for Applications was principally during the late afternoon or in the morning after the dew had dried off. Only one application was made in the early morning while the plants were soaking wet and the maximum burning effect was noticed with this particular application.

With these brief explanations the balance of the data can be included in Table No. 22.

TABLE No. 22. SUMMARY OF AIRPLANE DUSTING OPERATIONS.
LOUISIANA EXPERIMENT STATION, 1926.

Date 1926	Locality	No. Loads	Dust Used	Lbs. Used	Acres Dusted	Rate Per Acre	Flying Time Min.
9/25	X-C (Flying from Baton Rouge to Plaquemine and return)						16
9/25	B R	1	J X Lt.	100	16	6	6
9/27	X-C (Flying from Plaquemine to Baton Rouge)						10
9/27	B R	1	J X Lt.	550	32	18	9
9/28	B R	1	J X Lt.	150	16	9.5	6
9/28	X-C (Flying from Baton Rouge to Plaquemine)						10
9/28	Pl.	1	J X Lt.	550	50	11	17
9/29	Pl.	2	J X Lt.	1,100	100	11	27
10/1	Pl.	6	J X Lt.	3,300	300	11	59
10/7	Pl.	1	J X Lt. & 10% L.	275	25	5, 10, 15, 20	14
10/13	Pl.	1	J X Lt. & 10% Fl.	305	24	10, 18	7
10/13	Pl.	1	Va.-Car.	100	8	10, 20	7
10/13	Pl.	1	Va.-Car. & 10% L.	110	16	5, 10	7
10/15	Pl.	7	J X Lt. & 10% L.	3,500	175	20	68
10/16	Pl.	8	J X Lt. & 10% L.	4,000	200	20	60
10/18	Pl.	6	J X Lt. & 10% L.	3,000	150	20	45
10/19	Pl.	2	J X Lt. & 10% L.	1,000	50	20	12
10/19	Pl.	1	J. "Light"	100	5	20	5
10/19	Pl.	1	Bartlett's	60	4	15	4
10/20	Pl.	1	Grasselli's	80	4	20	5
10/20	Pl.	1	Va.-Car.	200	10	20	5
10/20	Pl.	3	J X Lt. & 10% L.	1,500	75	20	19
10/20	Pl.	1	J X Lt. & 10% L.	500	25	20	6
Totals		47		20,480	1,285	(Average) 16	424

This extensive work proves conclusively that the airplane is well adapted to use in dusting. The planes which are built especially for insecticidal work can certainly be depended upon to discharge the dust at any desired rate up to at least 20 pounds per acre. A plane having the capacity of that used in our work can treat at least 200 acres per hour, at the rate of 20 pounds per acre, when the acreage is concentrated and with the possibility of dust swaths about one-half mile long, if the landing field is located within 4 or 5 miles of the area to be dusted.

CONCLUSIONS

1. Efforts to control the sugarcane borer by dusting with arsenate of lead or with calcium arsenate have failed.

2. The first known successful control of cane borers by an insecticide application was accomplished at the Lou-

isiana Experiment Station in September, 1925, through an application of sodium silicofluoride, distributed by an airplane.

3. Further hand gun dusting tests in October, 1925, indicated the possibility of destroying more than two-thirds of the borers in dusted cane and that the poison continued to kill borers for two weeks or more after its application.

4. Corn makes a more favorable test plant for silicofluoride dusting than does cane because of its more tender foliage and also its heavier infestation with borers.

5. Many tests have shown the possibility of destroying two-thirds or more of the borer larvae in corn or in cane.

6. Many tests have shown that the addition of 10% by weight of hydrated lime to sodium silicofluoride dusts decreases the tendency to burn the foliage of both corn and cane.

7. The addition of larger proportions of hydrated lime does not entirely remove the possibility of burning but does decrease materially the control of borers.

8. Sodium silicofluoride has been the most promising dust for extensive use thus far but the silicofluorides of aluminum, barium and magensium deserve further study.

9. The effectiveness of silicofluoride dusts appears to depend upon their water soluble elements principally.

10. The silicofluorides act both as a stomach and also as a contact poison to borers. Larvae may die within an hour from contact with the dust or from being wet in its solution.

11. Silicofluoride dusting does not appear to destroy the Trichogramma egg parasites either within the borer eggs before they emerge or in their attack on freshly laid borer eggs in dusted fields.

12. Extensive airplane dusting tests conducted in 1926 indicated that an application of from 15 to preferably about 20 pounds of silicofluoride dust per acre is advisable to secure satisfactory control results.

13. This dusting, with the best materials found in the Louisiana Station work for 1926, and at a rate of not more

than 20 pounds per acre on dry cane, may be considered absolutely safe so far as any danger of burning the eyes is concerned in even the most tender varieties of cane.

14. The percentage of larvae destroyed in the tops of cane may be expected to be considerably higher than the percentage in their burrows in the butts of cane.

15. The highest percentages of mortality among larvae of all sizes may be found in examinations made from 5 to 8 days after the dust is applied. There is considerable mortality continuing to or beyond the 16th day.

16. The ultimate effect of control measures for the borer may be seen only at the end of the season through an actual determination of the percentage of joints showing borer burrows in dusted areas as compared with similar examinations in comparable cane which has not been dusted or otherwise treated.

17. Through an examination of 1166 stalks of undusted cane of four native varieties, it was found that 26.2% of the joints showed borer burrows in the late fall of 1926 and in comparison with this where one dust had been applied from six to eight weeks previously, there was found but 12.1% of joints bored.

18. In the dusted cane only about one-half as many living borer stages occurred as were found in the undusted cane.

19. It has been proven conclusively that properly constructed airplanes are capable of applying any good dust material to cane in a thorough manner.

20. With the best dust materials used in 1926, and under favorable atmospheric conditions, a dust swath width of approximately 100 feet could be covered with an effective cloud of dust.

21. With a dust rate of 20 pounds per acre, and on concentrated acreage, at a distance of less than 5 miles from landing field, at least 200 acres per hour may be treated.

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Agricultural Experiment Stations

OF THE

Louisiana State University and Agricultural and Mechanical College

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SUGAR CANE TEST FIELD WORK

BY

C. B. GOUAUX,
Sugar Cane Specialist

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SUGAR CANE TEST FIELD WORK

BY

C. B. GOUAUX, *Cane Specialist*

For a long time it has been felt that the experimental data that were secured from any one field or in any one locality might not be judiciously applied to the sugar industry as a whole. The variations in soils, drainage, and other local conditions from river to bayou, and from bayou to the high lands of the western section are so considerable that general practices in one section that are efficient may be entirely inadequate or impractical in another. In order to remedy this situation and also to have the work of the Louisiana State University Experiment Station in a position to be in convenient access to as many of the people as possible, Director Dodson conceived the idea of establishing test fields in representative sections of the state from which the work of the Station at Baton Rouge could be further tested and demonstrated, and where valuable information peculiar to the local sections could be secured and furnished to the Louisiana Sugar industry. In 1924 he secured permission from the Board of Supervisors of the University to use Experiment Station funds for the support of such test fields.

At a meeting of the Agricultural Committee of the American Sugar Cane League in the fall of 1924, Director Dodson presented the plan for establishing test fields in representative sections of the sugar belt. At this meeting a resolution was passed accepting the recommendation, and the Experiment Station started the first definite test field work in the fall of 1924. The following test fields were selected:

1. Reserve, on the lower Mississippi river.
2. Glenwood, on bayou Lafourche.
3. Sterling, on bayou Teche.
*4. Minerva, on bayou Terrebonne.
5. Angola, on the upper Mississippi river.

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*The Minerva location was changed to Raceland on bayou Lafourche.

The sugar cane variety work was started with small amounts of some of the most promising varieties at all of the test fields. The plantings were made on the introductory "line row" basis.

In addition to the variety work, other projects along the lines of seed selection, seed treatment for root rot complex, and experiments with legume crops and fertilizers were undertaken at three of the test fields, viz, Glenwood, Raceland and Reserve. In the fall of 1925 the test field varieties were harvested and the test field plantings extended on a larger scale on the field row basis. On account of the severe borer damages to the other experiments, that were started, no effort was made to secure the final data at harvest time. Due to the pressing need regarding information on new varieties, all of our efforts were finally concentrated on variety tests and the other projects were dropped temporarily.

In the fall of 1926 at a meeting held on Glenwood plantation, near Napoleonville, with representatives of the Experiment Station, the U. S. Office of Sugar Plants, and the American Sugar Cane League, a standard plan for testing sugar cane varieties on the test fields was adopted by the Office of Sugar Plants and Experiment Station. It was decided to use the following varieties: P. O. J. Nos. 36, 213, 228, 234, 826, 979 and 2379, and D-74 and Louisiana Purple. In the new plan adopted, provisions were made to make the variety planting in three row plats, one-twentieth acre in size, checkerboard arrangement of plats, with replications of each variety varying rom 4 to 10.

The following method of conducting mill tests of the most promising varieties during the harvesting period, was also adopted:

(1) Minimum amount of four tons of cane to be used in tests, without maceration.
(2) Crusher juice; Brix, Sucrose and Purity.
(3) Mixed juice: Brix, Sucrose, Purity and Glucose.
(4) Residual juice: Brix, Sucrose and Purity.
(5) Bagasse: Sucrose, Moisture and Fiber.

(6) Handmill analyses to be performed at regular intervals, starting in October and extending through the grinding season.

The new plan was put into effect in the fall of 1926, and the following test fields were planted according to the approved method: Glenwood, Reserve, Cinclare*, Sterling and Youngsville. The other projects first started were entirely discontinued, and the work confined to agricultural studies and the testing of sugar cane varieties.

TEST FIELD LOCATIONS AND SOIL TYPES

The Glenwood test field is located in the parish of Assumption on bayou Lafourche, near Napoleonville, on Glenwood plantation of the Glenwood Sugars, Inc. The type of soil varies from sandy clay loam to clay loam.

The Reserve test field is located in the parish of St. John on the lower Mississippi river, at Reserve, on Reserve plantation of the Godchaux Sugars, Inc. The type of soil is sandy clay loam.

The Cinclare test field is located in the parish of West Baton Rouge on the upper Mississippi river, near Brusly, on Cinclare-Addition plantation of the Estate Harry L. Laws. The type of soil is sandy clay loam.

The Sterling test field is located in the parish of St. Mary on bayou Teche, near Franklin, on West Belleview plantation of the Sterling Sugars Inc. The type of soil is clay loam, with impervious heavy clay subsoil.

The Youngsville test field is located in the parish of Lafayette, one mile from Youngsville, on the plantation of Mr. F. M. Burley. The type of soil is Olivier silt loam, characteristic of the section.

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*At the Annual Meeting of the American Sugar Cane League, September 30, 1926, an arrangement was made for the exchange of the Raceland test field for Cinclare, in West Baton Rouge parish by the Experiment Station and U. S. Office of Sugar Plants.

HISTORY OF TEST FIELD LAND

Test Field	Year	Cropping System
Glenwood	1922	Corn and soy beans. Legume harvested for hay.
	1923	Plant Cane.
	1924	First year stubble.
	1925	Corn and soy beans. Legume plowed under.
	1926	Corn and soy beans. Legume plowed under. October 18-20, fall planting of test field varieties.
Reserve	1922	Corn and soy beans. Legume plowed under.
	1923	Plant Cane.
	1924	First year stubble.
	1925	Corn and soy beans. Legume plowed under.
	1926	Corn and soy beans. Legume plowed under. October 28, fall planting of test field varieties.
Cinclare	1922	Corn and soy beans. Legume turned under.
	1923	Plant Cane.
	1924	First year stubble.
	1925	Corn and soy beans. Legume plowed under.
	1926	Corn and soy beans. Legume plowed under. October 26-27, fall planting of test field varieties.
Sterling	1922	Corn and cowpeas. Legume harvested for hay.
	1923	Plant Cane.
	1924	First year stubble.
	1925	Corn and Velvet beans. Poor crops of both, legume harvested for hay.
	1926	Cotton. November 13, fall planting of test field varieties.
Youngsville	1922	Plant Cane.
	1923	First year stubble.
	1924	Corn and cowpeas. Legume plowed under.
	1925	Corn and cowpeas. Legume plowed under.
	1926	Irish potatoes and cotton (heavily fertilized). November 4, fall planting of test field varieties.

LAND PREPARATION

The test field operators used the same regular system of fall land preparation, as was used for their average plantation fields. The Reserve and Cinclare test fields used the following method: corn stalks and soy bean crop capped off with lister, followed by wrapping of middles and covering of corn stalks and soy beans with plows. After these two operations the middles were opened and the quarter drains cleaned out. At Glenwood the land was capped off with lister, and the corn stalks and soy beans wrapped in the middles with plows. A sub-soiler was passed on the old corn row, two furrows thrown back with plows, followed by disc harrow, opening of middles with lister, and the cleaning of quarter drains. At Sterling and Youngsville, the cotton rows were capped off with lister, followed by bedding up with plows, and the opening of middles and cleaning of quarter drains.

METHOD OF PLANTING

Each test field was first measured, and laid off into uniform one-twentieth acre plats. Small headlands 8 feet wide were left between each series of plats, to facilitate the planting and harvesting and provide a better means for inspecting the different varieties. The plantings were made according to the customary plantation practice, using two continuous running stalks without lap at all of the test fields.

Table No. I gives the varieties planted, and the number of replications of each:

TABLE NO. I

Number of one-twentieth acre plats:

Variety	Glenwood	Y'ngsville	Cinclare	Sterling	Reserve
P. O. J. 36......	5	4	4	4	5
” 213......	4	4	4	4	5
” 228......	5	4	5	4	5
” 234......	5	5	5	4	4
” 826......	5	3	5	4	5
” 979......	5	4	5	4	5
” 2379......	5	5	5	5	5
Purple	3	2	0	3	2
D-74	3	0	3	0	0
Purple (Sta.).....	0	3	0	0	3
P. O. J. 139......	0	2	0	0	0
Striped	0	0	4	0	0
Total	40	36	40	32	40

CULTIVATION AND FERTILIZATION

The test fields were given the same kind and number of cultivations as ordinary plantation field cane. No attempt was made in any way to give any special or better cultivation to the test fields. The Glenwood, Cinclare, Reserve and Sterling test fields were not fertilized, while the Youngsville test field varieties received a uniform fertilizer treatment in early April, consisting of a mixture of 200 pounds of Nitrate of Soda and 200 pounds of acid phosphate per acre, applied on each side of the row and covered with disc cultivator.

The final cultivation and lay-by of the test fields was as follows: Youngsville, June 25th; Cinclare, June 18th; Sterling, June 20th; Glenwood, June 15th; and Reserve, June 18th.

GERMINATION AND SUCKERING OF VARIETIES

During the early part of spring the varieties were carefully inspected at different intervals, and notes and observations were made on the characteristics of the varieties, from the standpoints of germination, stands and earliness in suckering.

In comparing the P. O. J. canes with the old varieties, P. O. J. 234 was the earliest germinating and suckering variety. P. O. J. 36, 213, 228, and 979 started suckering earlier than the old canes; D-74, Purple and Striped.

In making the germination and suckering counts, a representative plat of each variety on trial was taken at each test field. The first counts were made in the spring, from March 18-24, and at this time all of the mother stalks were counted, and the total number of stalks per acre calculated. The spring counts give a good idea of the germinating qualities of the varieties.

The second counts were made in the summer, during the growing period of July 28, to August 13, and at this time the total number of mother stalks and suckers was counted in the same series of plats. The total number of stalks per acre in the summer counts shows the suckering qualities of the different varieties. P. O. J. 213 is the most prolific suckering variety at all test fields, while P. O. J. 234 is second at Reserve and Youngsville, and P. O. J. 228 second at Glenwood, Sterling and Cinclare. From an early germinating and early suckering standpoint P. O. J. 234 is the outstanding variety, followed by P. O. J. Nos. 979 and 228.

Table No. II gives the data on the germination and suckering of the test field varieties.

NOTE—All figures represent total stalks per acre.

TABLE NO II

	Reserve		Glenwood		Sterling		Youngsville	
Date	3-18	7-28	3-22	7-29	3-23	8-2	3-24	8-3
Variety	Stalks Per Acre							
P. O. J. 36	5,060	40,080	6,920	33,270	7,210	26,100	11,100	33,150
” 213	7,500	44,490	9,650	41,280	6,490	28,830	10,240	42,480
” 228	5,020	40,770	8,990	38,700	5,080	26,460	8,680	33,750
” 234	11,580	43,440	10,100	34,170	10,210	23,280	15,960	37,500
” 826	6,020	36,240	7,130	22,890	9,750	22,140	6,360	24,300
” 979	4,970	34,020	9,850	30,150	5,540	19,830	8,310	30,060
” 2379	5,730	32,490	7,110	30,960	7,900	26,820	8,310	30,060
Purple	5,140	......	3,160	8,190	5,230	13,950	15,200	23,190
Purple (Sel.)	4,660	25,950	......	......	......	......	5,020	17,130
D-74 (Sel.)	......	......	4,720	16,890	......	......	......	......

	Cinclare	
Date	3-17	8-13
Variety	Stalks Per Acre	
P. O. J. 36	3,780	30,120
” 213	6,220	39,780
” 228	8,580	37,170
” 234	12,890	35,820
” 826	5,480	28,950
” 979	7,770	30,060
” 2379	6,870	27,900
D-74	3,570	22,590
Striped	6,630	21,330

GROWTH MEASUREMENTS OF VARIETIES

In order to compare the growth progress of the different varieties, the growth of ten to twelve average stalks, most advanced in growth, in the same series of plats where the germination and suckering counts were made, were measured at different intervals, early and late summer. The stalks were measured from the top of the row, at the base of the plants, to the last growth ring in the top of the leaf spindle.

In both the first and second measurements, the first three leading varieties, from the standpoint of height, were as follows:

Reserve, Glenwood and Cinclare: (1) P. O. J. 234; (2) P. O. J. 213; (3) P. O. J. 36.

Sterling: (1) P. O. J. 36; (2) P. O. J. 234; (3) P. O. J. 213.

While at Youngsville, the first three varieties, in the first measurements were as follows: (1) P. O. J. 213; (2) P. O. J. 234; (3) Purple.

Second measurements: (1) P. O. J. 36; (2) P. O. J. 234; (3) P. O. J. 213.

MOSAIC AND "RED STRIPE" DISEASES

The Java seedlings are generally known for their great resistance, and in some cases practical immunity to mosaic disease. With their vigorous root system these varieties are capable of making an excellent growth and thriving well, even under mosaic conditions. In observing mosaic disease on the test fields in the three released varieties, P. O. J. Nos. 234 and 36 showed the heaviest infestations, while P. O. J. 213 was very highly resistant. In the other P. O. J. varieties on trial, P. O. J. Nos. 228 and 979 are also highly resistant, while P. O. J. Nos. 826 and 2379 showed very heavy infestations.

The new disease which shows up in the form of red stripes on the leaves of sugar cane, was first noticed by Dr. C. W. Edgerton, Experiment Station Pathologist, in the early part of July: It was found on Cayana, D-74, Purple and P. O. J. Nos. 36, 213, 228 and 234 at the Baton Rouge Sugar Experiment Station. The disease is caused by a species of bacterium, and can be transmitted from diseased to healthy plants by inoculation. A short time after it was reported, examinations for the disease were made at the test fields. In the test plats at Reserve, P. O. J. 228 showed the heaviest infestation, about 20%, P. O. J. 2379, 15% and P. O. J. 826 traces. At Glenwood and Cinclare, it occurred in the same varieties to a smaller extent, with quite a heavy infestation in D-74. Red stripe disease was also found in field plantings of P. O. J. Nos. 36 and 234 at Glenwood. It also occurred in all plats at Sterling, and was noticed for the first time on P. O. J. 979. At Youngsville it was found in all of the plats including P. O. J. 979 and Purple (Station selected), with quite a heavy infestation in P. O. J. 213.

CANE BORER INFESTATION

In order to compare the effect of cane borers on the different varieties on trial, a number of counts were made on the test field varieties, given below. The counts at Cinclare were made by the Experiment Station Department of Entomology.

Variety	Glenwood	Reserve	Cinclare	Youngsville
	7-1-27	6-30-27	7-1-27	6-21-27
P. O. J. 36......	9%	12%	1.7%	1.2%
" 213......	8%	12%	3.2%	2.4%
" 228......	8%	10%	2.5%	....
" 234......	10%	17%	1.7%	3.4%
" 826......	8%	18%	2.1%	1.2%
" 979......	4%	10%	3.2%	1.4%
" 2379......	3%	15%	2.8%	....
D-74	6%	....	1.3%	....
Purple	....	11%	....	2.2%
Striped	....	....	3.9%	....

The varieties were inspected at later intervals during the season, and from the observations made, P. O. J. 213 suffered to a greater extent from borer damages, followed by P. O. J. Nos. 234 and 36. The other P. O. J. canes were damaged to about the same extent as P. O. J. 36, and the old varieties also showed about the same amount of damages. The cane borers were entirely controlled in the latter part of the season by the cane borer egg parasite, Trichogramma minutum.

Variety	e	Cinclare		Sterling		Youngsville	
	Pur.	Date	% Pur.	Date	% Pur.	Date	% Pur.
P. O. J. 36	54.30	11/4	65.30	10/6	71.36	10/17	64.50
	70.00	11/11	74.18	10/20	78.68	10/24	87.20
	72.00	1/13	34.50	11/2	83.76	10/31	70.00
				11/15	89.09	11/19	77.00
				12/15	88.41	11/21	77.40
				12/28	89.80	12/21	81.50
				1/7	87.32		
P. O. J. 213							
						10/24	65.80
						11/9	72.20
						12/16	79.75
						12/21	80.75
P. O. J. 228							
		10/7	72.10				
		10/18	71.08				
		10/26	74.74				
		11/4	79.13				
		11/11	77.98				
P. O. J. 234				10/6	72.67	10/17	74.60
				10/20	82.02	10/24	78.40
	*	10/7	73.70	11/2	88.45	10/31	83.60
	*	10/18	72.38	11/15	89.02	11/9	81.90
	*	10/26	65.00	12/15	92.13	11/21	86.00
	*	11/4	72.91	12/28	89.52	12/16	88.00
	*	11/11	70.05	1/7	88.44	12/21	88.75
P. O. J. 826						10/17	72.20
						10/24	62.80
						10/31	78.80
						11/9	77.10
						11/21	79.40
						12/16	71.50
						12/21	85.40
P. O. J. 979	70.40					10/17	75.00
	70.00					10/24	79.20
						10/31	79.70
						11/9	68.10
						11/21	81.80
						12/16	87.90
						12/21	87.60

15% and P. O. J. 826 traces. At Glenwood and Cinclare, it occurred in the same varieties to a smaller extent, with quite a heavy infestation in D-74. Red stripe disease was also found in field plantings of P. O. J. Nos. 36 and 234 at Glenwood. It also occurred in all plats at Sterling, and was noticed for the first time on P. O. J. 979. At Youngsville it was found in all of the plats including P. O. J. 979 and Purple (Station selected), with quite a heavy infestation in P. O. J. 213.

CANE BORER INFESTATION

In order to compare the effect of cane borers on the different varieties on trial, a number of counts were made on the test field varieties, given below. The counts at Cinclare were made by the Experiment Station Department of Entomology.

Variety	Glenwood	Reserve	Cinclare	Youngsville
	7-1-27	6-30-27	7-1-27	6-21-27
P. O. J. 36......	9%	12%	1.7%	1.2%
" 213......	8%	12%	3.2%	2.4%
" 228......	8%	10%	2.5%	....
" 234......	10%	17%	1.7%	3.4%
" 826......	8%	18%	2.1%	1.2%
" 979......	4%	10%	3.2%	1.4%
". 2379......	3%	15%	2.8%	....
D-74	6%	....	1.3%	....
Purple	....	11%	....	2.2%
Striped	....	....	3.9%	....

The varieties were inspected at later intervals during the season, and from the observations made, P. O. J. 213 suffered to a greater extent from borer damages, followed by P. O. J. Nos. 234 and 36. The other P. O. J. canes were damaged to about the same extent as P. O. J. 36, and the old varieties also showed about the same amount of damages. The cane borers were entirely controlled in the latter part of the season by the cane borer egg parasite, Trichogramma minutum.

TABLE NO. III

Variety	Glenwood		Reserve		Cinclare		Sterling		Youngsville	
	Date	% Pur.	Date	% Pur.	Date	% Pur.	Date	% Pur.	Date	% Pur.
O. J. 36	10/20 11/8 12/8	75.20 81.40 85.30	10/24 10/31 11/7	69.80 69.30 72.00	10/7 10/18 10/26 11/4 11/11 **1/13**	65.90 66.00 72.87 70.30 72.30 **43.20**	10/6 10/20 11/2 11/15 12/15 12/28 1/7	74.84 78.06 81.88 86.34 89.69 90.92 87.81	10/17 10/24 10/31 11/9 12/16 12/21	74.80 73.30 71.80 76.80 75.75 88.35
P. O. J. 213	10/20 11/8 12/8	75.20 83.80 87.30	10/24 10/31 11/7	76.20 71.20 76.80	10/7 10/18 10/26 11/4 11/11 1/13	67.10 77.86 80.01 77.63 83.32 52.00	10/6 10/20 11/2 11/15 12/15 12/28 1/7	74.45 82.81 85.74 88.36 88.58 88.90 86.18	10/17 10/24 10/31 11/9 11/21 12/16 12/21	74.30 80.40 78.50 77.50 85.80 83.75 82.50
P. O. J. 228	10/20 11/8 12/8	66.50 72.90 80.90	10/24 10/31 11/7	70.80 68.60 70.40	10/7 10/18 10/26 11/4 11/11 1/13	58.20 62.36 65.76 67.73 71.01 45.30	10/6 10/20 11/2 11/15 12/15 12/28 1/7	68.40 73.10 77.38 85.89 85.82 87.58 84.08	10/17 10/24 10/31 11/9 11/21 12/16 12/21	72.50 74.30 71.80 77.05 78.40 80.30 89.35
P. O. J. 234	10/20 11/8 12/8	81.40 85.60 88.70	10/24 10/31 11/7	73.40 74.20 77.90	10/7 10/18 10/26 11/4 11/11 1/13	74.70 81.81 77.01 78.06 80.64 52.90	10/6 10/20 11/2 11/15 12/15 12/28 1/7	82.22 81.02 87.10 88.61 88.42 91.05 89.50	10/17 10/24 10/31 11/9 11/21 12/16 12/21	76.50 77.50 72.80 80.50 84.00 81.60 90.00
.O. J. 826	10/20 11/8 12/8	70.00 72.90 82.20	10/24 10/31 11/7	73.40 71.80 69.00	10/7 10/18 10/4 11/11 1/13	60.60 62.50 67.98 69.08 34.80	10/6 10/20 11/15 12/15 12/28 1/7	73.42 75.93 88.58 87.08 88.59 85.90	10/17 10/24 10/31 11/9 11/21 12/16 12/21	66.90 74.80 75.60 79.30 79.80 77.90 78.23
O. J. 979	10/20 11/8 12/8	70.20 79.60 84.30	10/24 10/31 11/7	64.80 70.80 69.60	10/7 10/18 10/26 11/4 11/11 1/13	69.50 65.38 68.76 72.53 75.12 50.00	10/6 10/20 11/2 11/15 12/15 12/28 1/7	69.33 80.00 80.48 85.13 86.52 88.12 86.03	10/17 10/24 10/31 11/9 11/21 12/16 12/21	72.50 75.70 73.60 75.00 78.90 76.90 83.00
P. O. J. 2379	10/20 11/8 12/8	66.00 79.40 77.40	10/24 10/31 11/7	64.30 70.00 72.00	11/4 11/11 1/13	65.30 74.18 34.50	10/6 10/20 11/2 11/15 12/15 12/28 1/7	71.36 78.68 83.76 89.09 88.41 89.80 87.32	10/17 10/24 10/31 11/19 11/21 12/21	64.50 87.20 70.00 77.00 77.40 81.50
P. O. J. 2714	10/20 11/8	63.70 73.60								
P. O. J. 2725	10/20 11/8	68.60 79.80							10/24 11/9 12/16 12/21	65.80 72.20 79.75 80.75
L-1277	10/20 11/8	80.60 87.00								
D-74	10/20 11/8	79.70 76.90			10/7 10/18 10/26 11/4 11/11	72.10 71.08 74.74 79.13 77.98				
Field Run Purple and *Striped	10/20 11/8 12/8	75.60 79.20 83.90			*10/7 *10/18 *10/26 *11/4 *11/11	73.70 72.38 65.00 72.91 70.05	10/6 10/20 11/2 11/15 12/15 12/28 1/7	72.67 82.02 88.45 89.02 92.13 89.52 88.44	10/17 10/24 10/31 11/9 11/21 12/16 12/21	74.60 78.40 83.60 81.90 86.00 88.00 88.75
P. O. J. 139									10/17 10/24 10/31 11/9 11/21 12/16 12/21	72.20 62.80 78.80 77.10 79.40 71.50 85.40
Station Purple			10/24 10/31	70.40 70.00					10/17 10/24 10/31 11/9 11/21 12/16 12/21	75.00 79.20 79.70 68.10 81.80 87.90 87.60

HANDMILL ANALYSES OF VARIETIES

During the fall period, starting in the early part of October, a series of handmill analyses was made at different intervals, extending throughout the grinding season. Although the varieties were harvested in the latter part of November, sufficient quantities consisting of 40 to 50 stalks of each variety, were left standing to furnish samples for later tests. The handmill analyses were performed by the chemists of the cooperating plantation test fields. The samples consisted of four and five stalks taken at random in the variety plats, representing field run mill cane as much as possible.

In tables Nos. 3 and 4, which follow the comparative Purities from the Handmill analyses of test field varieties, both plant and stubble cane are given.

TABLE NO. IV
Stubble Cane

Variety	GLENWOOD		RESERVE	
	Date	% Purity	Date	% Purity
P. O. J. 36........	10-20 11-8	80.00 73.30	11-7	79.80
P. O. J. 213.......	10-20 11-8	82.50 81.50	10-31 11-7	80.80 76.20
P. O. J. 228.......	10-20 11-8	72.80 79.80	10-31	78.10
P. O. J. 234.......	10-20 11-8	84.20 86.30	10-31	74.40
P. O. J. 826.......	10-20 11-8	75.10 79.70	10-31 11-7	82.90 80.70
P. O. J. 979.......	10-20	72.50	10-31 11-7	77.90 74.20
P. O. J. 2379......	10-20 11-8	76.50 82.10	10-31 11-7	82.70 82.60
P. O. J., 2714......	10-20 11-8	64.10 68.60		
P. O. J. 2725......	10-20 11-8	72.60 78.30		
D-74	10-20 11-8	79.10 81.20	11-7	78.20*
L-1277	10-20	73.30		
Purple	10-20 11-8	73.60 85.20	10-31 11-7	85.40 77.00
Purple*			10-31 11-7	78.20 81.60

*—Second Year Stubble

TABLE NO. V

Average of Handmill Analyses. (Plant Cane) For Each Test Field.

Oct. 6, 1927 to Jan. 7, 1928.

Variety	Glenwood	Cinclare	Reserve	Sterling	Youngsville
P. O. J. 36—Brix	15.29	13.36	13.85	16.54	15.30
Sucrose	12.42	9.30	9.75	13.99	11.96
Purity	80.63	69.47	70.37	84.22	77.69
P. O. J. 213—Brix	15.36	14.45	14.70	16.50	15.61
Sucrose	12.69	11.21	10.99	14.08	12.58
Purity	82.10	77.18	74.73	85.07	80.39
P. O. J. 228—Brix	14.04	12.60	13.52	16.32	15.84
Sucrose	10.38	8.25	9.45	13.19	12.35
Purity	73.42	65.01	69.93	80.32	77.67
P. O. J. 234—Brix	16.05	15.11	14.90	17.97	16.71
Sucrose	13.72	11.88	11.21	15.65	13.52
Purity	85.33	78.44	75.17	86.85	80.41
P. O. J. 826—Brix	14.47	12.53	13.55	16.89	15.23
Sucrose	10.79	8.18	9.67	14.13	11.51
Purity	75.03	65.04	71.40	83.25	76.08
P. O. J. 979—Brix	15.37	13.99	13.57	17.36	16.37
Sucrose	11.92	9.85	8.62	14.36	12.56
Purity	78.03	70.26	68.40	82.23	76.51
P.O.J. 2379—Brix	14.66	13.85	13.78	17.59	15.15
Sucrose	10.96	9.68	9.51	14.82	11.58
Purity	74.27	69.74	68.77	84.06	76.27
P. O. J. 139—Brix	....	....	....	....	16.24
Sucrose	....	....	....	....	12.25
Purity	....	....	....	....	75.31
P.O.J. 2714—Brix	12.61	....	....	....	....
Sucrose	8.69	....	....	....	....
Purity	68.65	....	....	....	....

Variety	Glenwood	Cinclare	Reserve	Sterling	Youngsville
P.O.J. 2725—Brix	14.47	....	....	....	15.28
Sucrose	10.81	....	....	....	11.45
Purity	74.20	....	....	....	74.63
D-74 — Brix	16.21	14.80	....	....	....
Sucrose	12.69	11.01	....	....	....
Purity	78.30	74.26	....	....	....
Purple — Brix (Plantation)	14.65	....	....	16.82	16.25
Sucrose	11.47	....	....	14.53	13.42
Purity	79.57	....	....	86.04	83.04
Purple — Brix (Sta.)	....	....	13.20	....	15.57
Sucrose	....	....	9.26	....	12.46
Purity	....	....	70.20	....	79.90
L-1277 — Brix	15.60	....	....	....	....
Sucrose	13.11	....	....	....	....
Purity	83.80	....	....	....	....
Striped — Brix	....	13.60	....	....	....
Sucrose	....	9.65	....	....	....
Purity	....	70.81	....	....	....

No.	Juice		Bagasse					
	c.	Pur.	% H2O	% Fiber		Lbs. Cane Gr'nd	Lbs. Ba-gasse	% Fibre Cane
1—	.03	71.8	57.2	36.8	60.0	967	386	14.68
2—	.73	60.8	57.4	35.2	67.5	922	300	11.45
3—	.82	69.6	55.3	34.4	64.0	842	303	12.37
4—	.56	69.9	55.2	35.2	64.0	835	342	14.41
5—	.56	70.9	55.1	38.4	59.0	705	252	13.72
6—	.65	71.6	57.2	38.8	65.0	780	272	13.53
7—	.91	67.2	59.1	36.8	63.7	939	341	13.30
8—	.05	67.1	...	39.6	67.7	786	253	12.74
9—	.58	73.4	60.1	32.4	64.1	882	316	11.60
10—	.51	75.6	58.2	35.2	65.0	829	300	12.73
11—	.69	68.2	63.0	30.0	63.8	948	325	10.28
12—	.25	75.9	56.7	36.0	64.6	933	330	12.73
13—	.79	67.3	63.8	30.0	64.7	730	257	10.56
14—	.99	65.5	56.6	39.2	63.2	900	331	14.41
15—	.50	77.4	54.9	36.0	62.0	900	341	13.64
16—	.50	64.7	56.4	37.2	64.0	750	250	12.40
17—	.49	58.8	57.0	30.8	66.6	920	319	10.68
18—	.96	70.6	56.9	40.0	63.4	1166	425	14.58
19—	.83	67.0	57.2	34.4	64.6	1019	360	12.15
20—	.63	72.8	55.8	37.6	61.2	552	204	13.89
21—	.80	66.3	59.2	...	62.9	830	312	....
22—	.15	62.8	60.6	32.2	63.0	961	346	11.59
23—	.93	62.1	34.0	65.0	65.0	997	349	11.90
24—	.34	67.8	58.4	38.8	65.8	875	299	13.25
25—	.20	69.2	57.2	36.4	62.6	6590	...	....
	.68	66.4	...	...	...	....	...	....
	.68	66.3	...	...	64.2	....	...	....

Variety	Glenwood	Cinclare	Reserve	Sterling	Youngsville
P.O.J. 2725—Brix	14.47	....	....	....	15.28
Sucrose	10.81	....	....	....	11.45
Purity	74.20	....	....	....	74.63
D-74 — Brix	16.21	14.80	....	....	....
Sucrose	12.69	11.01	....	....	....
Purity	78.30	74.26	....	....	....
Purple — Brix	14.65	....	....	16.82	16.25
(Plantation)					
Sucrose	11.47	....	....	14.53	13.42
Purity	79.57	....	....	86.04	83.04
Purple — Brix	....	....	13.20	....	15.57
(Sta.)					
Sucrose	....	....	9.26	....	12.46
Purity	....	....	70.20	....	79.90
L-1277 — Brix	15.60	....	....	....	....
Sucrose	13.11	....	....	....	....
Purity	83.80	....	....	....	....
Striped — Brix	....	13.60	....	....	....
Sucrose	....	9.65	....	....	....
Purity	....	70.81	....	....	....

TABLE NO. VI

Result of Mill Tests on P. O. J. Varieties

No. Source	Variety	Crusher Juice			Mixed Juice							L. R. Juice			Bagasse					
		Brix	Suc.	Pur.	Brix	Pol.	Cler.	% Gluc.	% Acid	Gluc. Ratio	Pur.	Brix	Suc.	Pur.	% H_2O	% Fiber		Lbs. Cane Gr'nd	Lbs. Ba-gasse	% Fibre Cane
	POJ																			
1—Minor Est....	213 2nd Stubble..	14.77	11.41	77.3	13.41	10.44	10.72	1.02	1.9	9.77	77.8	13.97	10.03	71.8	57.2	36.8	60.0	967	386	14.68
2—Godchaux ...	213 Plant	13.07	8.46	64.7	12.51	8.50	9.02	2.28	1.4	28.8	67.9	12.71	7.73	60.8	57.4	35.2	67.5	922	300	11.45
3—Est. Minor...	213 1st Stubble...	15.19	11.59	76.3	13.77	10.54	10.92	1.40	1.9	13.2	76.5	14.09	9.82	69.6	55.3	34.4	64.0	842	303	12.37
4—Youngsville ..	213	14.29	10.90	76.3	13.27	10.19	10.62	1.68	1.2	12.6	76.8	13.67	9.56	69.9	55.2	35.2	64.0	835	342	14.41
5—Glenwood	213 Plant	14.29	10.97	76.7	13.11	10.62	11.01	1.31	1.8	12.3	81.0	13.47	9.56	70.9	55.1	38.4	59.0	705	252	13.72
6—Sterling	213	15.07	11.46	76.0	14.47	11.05	11.42	1.61	2.1	14.5	76.3	14.87	10.65	71.6	57.2	38.8	65.0	780	272	13.53
7—Cinclare	213 Plant	13.69	10.12	73.9	13.07	9.87	10.25	1.74	1.7	17.6	75.5	13.26	8.91	67.2	59.1	36.8	63.7	939	341	13.30
8—Sugar Sta....	213 Stubble	14.08	10.32	73.3	13.64	10.22	10.69	1.64	1.9	16.0	74.9	13.49	9.05	67.1	...	39.6	67.7	786	253	12.74
9—Minor Est. ...	234 2nd Stubble..	16.60	13.58	81.8	15.94	12.91	13.24	1.15	1.9	8.9	80.9	15.77	11.58	73.4	60.1	32.4	64.1	882	316	11.60
10—Glenwood ...	234 Plant	15.71	12.71	80.9	14.81	11.96	12.20	1.04	2.1	8.6	80.8	15.21	11.51	75.6	58.2	35.2	65.0	829	300	12.73
11—Minor Est....	234 1st Stubble...	14.60	11.00	75.3	13.61	10.12	10.24	0.91	2.9	8.9	74.3	14.20	9.69	68.2	63.0	30.0	63.8	948	325	10.28
12—Glenwood	234 Stubble	17.17	14.36	83.6	15.87	13.24	13.43	1.09	1.7	8.2	83.4	16.13	12.25	75.9	56.7	36.0	64.6	933	330	12.73
13—Youngsville ..	234	14.97	10.95	73.1	14.27	10.65	11.04	1.93	1.5	18.1	74.6	14.53	9.79	67.3	63.8	30.0	64.7	730	257	10.56
14—Godchaux ...	234 Plant	15.27	10.93	71.6	14.84	10.83	11.24	1.67	1.9	15.4	73.0	15.23	9.99	65.5	56.6	39.2	63.2	900	331	14.41
15—Sterling	234	18.24	15.47	84.8	17.71	14.73	15.04	1.2	2.1	8.1	83.2	17.53	13.50	77.4	54.9	36.0	62.0	900	341	13.64
16—Sugar Sta....	36 Stubble	13.37	8.88	66.4	13.21	9.30	9.57	2.08	1.8	21.7	70.4	13.13	8.50	64.7	56.4	37.2	64.0	750	250	12.40
17—Godchaux ...	36 Plant	13.11	8.31	63.3	12.69	8.28	8.68	1.85	1.3	21.3	65.2	12.77	7.49	58.8	57.0	30.8	66.6	920	319	10.68
18—Glenwood	36 Stubble	16.21	13.20	81.4	15.41	12.47	12.69	1.51	1.8	12.1	80.1	15.59	10.96	70.6	56.9	40.0	63.4	1166	425	14.58
19—Glenwood	36 Plant	13.67	9.86	72.1	13.31	9.70	10.00	2.01	2.0	20.7	72.9	13.17	8.83	67.0	57.2	34.4	64.6	1019	360	12.15
20—Sterling	36	16.44	13.06	79.4	16.21	12.54	12.88	1.16	1.9	9.2	77.3	15.97	11.63	72.8	55.8	37.6	61.2	552	204	13.89
21—Youngsville ..	36 Plant	14.27	10.10	70.7	13.81	9.88	10.24	2.39	1.3	24.2	71.5	13.77	8.80	66.3	59.2	...	62.9	830	312	....
22—Cinclare	36 Plant	13.27	8.78	66.1	13.50	9.37	9.80	2.52	1.7	26.9	69.4	12.97	8.15	62.8	60.6	32.2	63.0	961	346	11.59
23—Minor Est....	36 1st Stubble...	13.24	9.06	68.5	12.91	8.99	9.14	1.70	2.6	18.9	69.6	12.77	7.93	62.1	34.0	65.0	65.0	997	349	11.90
24—Minor Est....	36 2nd Stubble..	14.17	10.10	71.3	12.91	9.04	9.32	1.98	1.7	21.9	70.0	13.77	9.34	67.8	58.4	38.8	65.8	875	299	13.25
25—Sugar Sta....	224 Stubble	15.27	11.41	74.7	14.92	11.37	11.54	1.07	2.5	9.4	76.2	14.74	10.20	69.2	57.2	36.4	62.6	6590	...	....
Sugar Sta.....	Purple	12.94	8.58	66.3	12.87	8.58					66.6	13.07	8.68	66.4	...	...	...	....	...	....
Sugar Sta.....	D-74 Stubble.....	13.39	9.30	69.4	13.39	9.08					67.8	13.09	8.68	66.3	...	...	64.2	....	...	....

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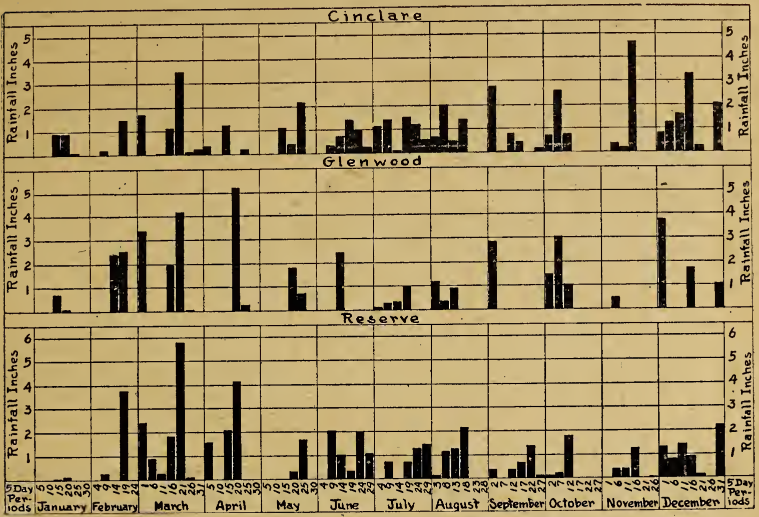
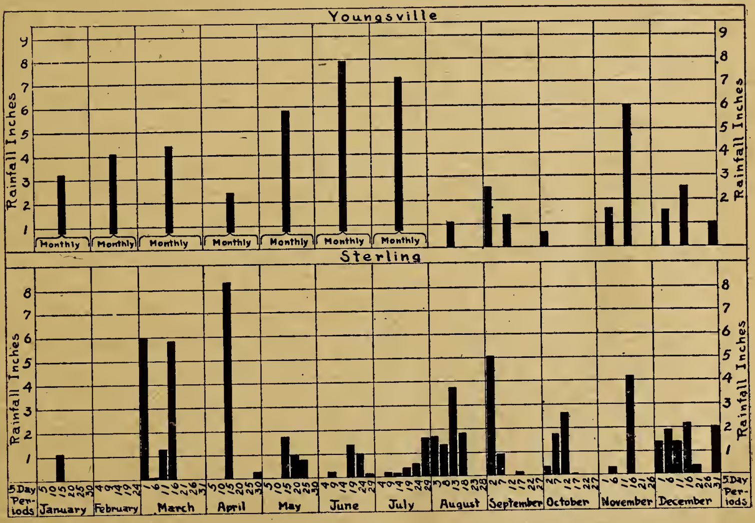
COMPARATIVE TEST FIELD RAINFALL CHARTS





In January conditions were very favorable, with light rainfall at all of the test fields, while February was also good at Glenwood and Youngsville, with heavier rains at the other places.

At Youngsville and Cinclare, the cultivating months, March, April, and May, were more favorable from the amounts and distribution of rainfall than at Glenwood, Sterling and Reserve.

During the best growing months, June, July, August and September, there was a fairly good amount of rainfall at all of the test fields except Glenwood.

The harvesting season, October, November and December, was favorable at all test fields, for the maturing of the cane, and for the subsequent harvesting of the crop.

" RESULTS OF MILL TESTS ON P. O. J. VARIETIES" CONDUCTED AT THE SUGAR EXPERIMENT STATION

At a committee meeting of the American Sugar Cane League, special sugar cane appropriation committee, held on October 14, 1927, a resolution was passed making arrangements with the Experiment Station for conducting mill trials of the three released P. O. J. varieties, from representative sections of the sugar belt, during the period just before the opening of the grinding campaign. The following locations were designated to furnish one-half ton lots of P. O. J. Nos. 36, 213 and 234; Cinclare, Reserve, Glenwood, Sterling, Youngsville, Estate H. C. Minor and the Sugar Station.

The Estate of H. C. Minor furnished the necessary amounts of P. O. J. Nos. 36 and 213, from their plantings at Cinclare, Sterling aand Youngsville, and P. O. J. 213 at Glenwood. Also giving one-half ton lots of P. O. J. Nos. 36, 213 and 234, first and second stubble, from their Terrebonne Properties. The other one-half ton lots of P. O. J. 234 plant cane were furnished by the following cooperating plantations: Glenwood Sugars, Inc., (also one-half ton of P. O. J. 36), Sterling Sugars, Inc., Estate Harry L. Laws, Godchaux Sugars, Inc., and F. M. Burley. The Sugar Station furnished one-half ton lots each of P. O. J. Nos. 36, 213 and 234 stubble, D-74 stubble and Purple (Sta.) plant cane.

In performing the mill tests, each variety lot was milled separately, constituting a series of twenty-seven mill tests, and the complete record of chemical data herewith presented was secured. The work was conducted under the supervision of Dr. W. R. Dodson, and Messrs. W. G. Taggart, J. J. Munson and W. P. Denson, on October 19, 1927.

HARVESTING OF STATION TEST FIELDS

In the harvesting of the test fields, close supervision and attention was given to the work, and excellent cooperation was given by general managers, field managers and overseers on the places where the test fields are located. Each variety plat in the checkerboard system of plats was harvested separately in sets of three rows, and the cane weighed. After weighing, mill tests were made with the combined replications of each variety at all of the Station test fields.

The following schedule of harvesting the test fields was followed:

Test Field	Date	No. of 1/20 Acre Plats.
Glenwood	Nov. 18-20	40
Youngsville	Nov. 18-20	30
Cinclare	Nov. 21-23	40
Sterling	Nov. 22	27
Reserve	Nov. 25-26	40

The final results consisting of field yield data and the chemical analyses of the varieties milled were obtained at all of the test fields. The officials in charge of both fields and factories gave excellent cooperation in supplying the necessary labor for harvesting, loading, and carts and wagons for hauling and weighing the cane, proper attention in the milling of each variety and the laboratory analysis of each of the varieties milled.

The amounts of cane milled in the series of large mill tests is given in table No. 7, which follows:

TABLE NO. VII

Amount of Cane Milled in Series of Large Mill Tests

Variety	Glenwood Pounds	Youngsville		Cinclare Pounds	Sterling		Reserve	
		Pounds	N. J. Ex.*		Pounds	N. J. Ex.	Pounds	N. J. Ex.
P. O. J. 36..	12,690	3,590	70.60	11,860	7,930	69.36	15,980	68.43
" 213..	9,830	3,450	71.80	12,440	5,990	71.45	12,480	73.44
" 228..	12,090	2,870	66.77	14,000	6,180	64.72	14,080	71.80
" 234..	10,150	3,650	73.23	13,420	6,470	72.44	13,060	69.37
" 826..	9,940	1,940	79.40	13,260	8,120	73.90	15,380	72.72
" 979..	9,460	2,470	77.35	12,660	6,050	66.80	11,140	76.30
" 2379..	9,260	2,350	74.50	14,340	10,380	67.63	13,560	71.64
Purple	1,390	2,670	77.25	.....	4,160	72.17	6,440	76.94
Purple .... (Sta.)	.....	1,865	78.35	.....	.....	....	5,020	75.90
P.O.J. 139..	.....	3,040	69.90	.....	.....	....	.....	....
D-74	3,530	....	....	6,030	.....	....	.....	....
Striped	.....	....	....	12,040	.....	....	.....	....

*—Normal Juice Extraction.

TABLE NO. VIII

Average Yield Per Acre of Each Variety
(Plant Cane)

Test Field	Glenwood	Y'ngsville	Cinclare	Sterling	Reserve
Variety	Tons per A	Tons per A	Tons per A	Tons per A	Tons per A
P. O. J. 36....	25.54	38.96	33.75	24.88	36.01
" 213....	24.76	34.28	33.10	18.98	37.57
" 228....	24.37	29.92	31.32	19.56	35.71
" 234....	20.42	34.33	27.00	20.38	30.92
" 826....	20.06	24.82	29.70	19.68	30.62
" 979....	19.08	26.36	27.59	19.42	30.50
" 2379....	18.69	28.22	28.83	20.40	27.90
Purple*	4.73	30.32	....	13.41	24.18
Purple (Sta)†..	....	22.45	....	....	25.05
P. O. J. 139 ...	....	27.32	....	....	25.02
D-74	11.99	....	20.55	....	....
Striped‡		....	30.10	....	....

*Purple: At Youngsville the plantings were made with stool selected plantation Purple, while at Glenwood, Sterling and Reserve field run Purple cane was used.

†Purple (Sta): The plantings were made with stool selected Purple cane, from the Baton Rouge Sugar Experiment Station.

‡Striped: Planted from regular field run plantation Striped cane.

TABLE NO. IX

General Average Yields Per Acre of the Five Test Fields for Each Variety

(Plant Cane)

Variety	Average Tons Per Acre	Variety	Average Tons Per Acre
P. O. J. 36	31.83	P. O. J. 2379	24.81
P. O. J. 213	29.74	P. O. J. 979	24.59
P. O. J. 228	28.18	Purple (Station)	23.75
P. O. J. 234	26.61	Purple (Field Run)	18.16
P. O. J. 826	24.98	D-74	16.27

Note: In the supervising work of harvesting and obtaining final results of the Station test fields, H. J. Rodrigues, Assistant in the work, handled the Glenwood and Cinclare test fields, and also assisted at Reserve. This made it possible to complete the work of the five test fields during the period of November 18 to 26th.

TABLE NO X

GLENWOOD TEST FIELD

Mill Tests of Sugar Cane Varieties. (Plant Cane)

(No maceration used on mills)

Glenwood Sugars, Inc., Napoleonville, La. Nov. 20, 1927.

Variety	Juice	Brix %	Sucrose %	Purity %	Glucose %	Lbs. 96° Sugar	
						Per Ton	Per Acre
P. O. J. 36	Crusher	14.60	11.78	80.68	1.1	149.4	3815.68
	Mixed	14.43	11.14	77.20			
	Residual	13.82	10.37	75.04			
P.O.J. 213	Crusher	15.20	12.77	84.01	.69	170.7	4226.53
	Mixed	14.73	12.07	81.94			
	Residual	14.29	10.77	75.37			
P. O. J. 228	Crusher	14.43	10.83	75.05	1.3	129.5	3155.92
	Mixed	14.26	10.52	73.77			
	Residual	13.46	9.31	69.17			
P. O. J. 234	Crusher	15.83	13.46	85.03	.52	181.5	3706.23
	Mixed	15.39	12.59	81.81			
	Residual	14.87	11.47	77.14			
P. O. J. 826	Crusher	14.83	11.56	77.95	1.1	166.5	3340.00
	Mixed	14.48	11.09	76.59			
	Residual	13.96	10.15	72.71			
P. O. J. 979	Crusher	15.06	11.66	77.42	1.4	161.6	3083.43
	Mixed	14.73	11.14	75.63			
	Residual	14.39	10.55	73.31			
P.O.J. 2379	Crusher	14.96	11.61	77.61	1.3	166.8	3117.49
	Mixed	14.19	10.79	76.04			
	Residual	14.17	10.05	70.92			
Purple	Crusher	15.17	12.38	81.61	1.1	167.8	793.69
(Field Run)	Mixed	13.48	11.03	81.82			
	Residual	12.46	9.19	73.76			
D-74	Crusher	15.46	12.86	83.18	.98	183.3	2197.76
(Station)	Mixed	15.23	12.13	79.65			
	Residual	14.52	11.07	76.24			

Note: In the calculations of pounds of 96° sugar, per ton and per acre, the same normal juice extractions for each variety, as was obtained in the Youngsville test field mill tests, with the exception of D-74. was used. For D-74 an assumed extraction of 78% was used.

TABLE NO. XI

YOUNGSVILLE TEST FIELD

Mill Tests of Sugar Cane Varieties. (Plant Cane)

(No maceration used on mills)

F. M. Burley, Youngsville, La.
Dr. R. O. Young, Youngsville, La.
Milton Syrup Factory, Milton, La.

Nov. 20, 1927.

Variety	Juice	Brix %	Sucrose %	Purity %	Lbs. 96° Sugar Per Ton	Lbs. 96° Sugar Per Acre
P. O. J. 36	Mixed	16.00	12.66	79.10	172.5	6720.60
	Residual	15.20	11.26	74.10		
P. O. J. 213	Mixed	14.75	11.62	78.75	160.5	5501.94
	Residual	14.70	11.43	77.78		
P. O. J. 228	Mixed	14.25	10.58	73.70	129.2	3865.66
	Residual	14.15	10.12	71.50		
P. O. J. 234	Mixed	16.75	13.56	80.90	193.9	6656.58
	Residual	16.25	12.48	76.75		
P. O. J. 826	Mixed	15.20	11.46	75.40	170.3	4226.84
	Residual	14.65	10.74	73.35		
P. O. J. 979	Mixed	16.30	12.43	76.30	181.4	4781.70
	Residual	16.50	12.32	74.70		
P.O.J. 2379	Mixed	14.85	11.13	75.00	154.8	4368.45
	Residual	14.90	10.97	73.60		
Purple (Station)	Mixed	16.05	12.90	80.35	196.8	4418.16
	Residual	15.40	12.02	78.10		
Purple (Plantation)	Mixed	16.10	13.18	81.90	200.6	6082.19
	Residual	15.65	12.27	78.35		
P. O. J. 139	Mixed	15.65	11.95	76.35	157.6	4305.67
	Residual	15.55	11.37	73.10		

Note: The Youngsville test field was fertilized in the early spring, at the rate of 200 pounds of Nitrate of Soda and 200 pounds of Acid Phosphate per acre. This was the only station test field that received fertilizer treatment.

TABLE NO. XII

CINCLARE TEST FIELD

Mill Test of Sugar Cane Varieties. (Plant Cane)

Maceration water added during milling

Cinclare Central Factory, Cinclare, La. Nov. 25, 1927.

Variety	Juice	Brix %	Sucrose %	Purity %	Glucose %	Lbs. 96° Sugar	
						Per Ton	Per Acre
P. O. J. 36	Crusher	13.71	9.96	72.65		129	4353.7
	Mixed	13.63	9.95	73.00	1.25		
	Residual	5.01	3.32	66.26			
P. O. J. 213	Crusher	14.39	11.32	78.67		154	6097.4
	Mixed	14.27	11.28	79.05	1.10		
	Residual	5.98	4.09	68.40			
P. O. J. 228	Crusher	14.04	9.93	70.73		122	3821
	Mixed	13.84	9.69	70.02	1.22		
	Residual	2.36	1.31	55.51			
P. O. J. 234	Crusher	14.84	11.81	79.58		158	4266
	Mixed	14.71	11.58	78.72	1.09		
	Residual	3.33	2.26	67.87			
P. O. J. 826	Crusher	13.71	9.14	66.67		109	3150.1
	Mixed	13.37	8.96	67.02	1.25		
	Residual	2.83	1.57	55.50			
P. O. J. 979	Crusher	14.99	10.95	73.05		137	3779.8
	Mixed	14.59	10.60	72.65	1.19		
	Residual	3.71	2.32	62.54			
P.O.J. 2379	Crusher	14.16	9.71	68.50		116	3344.2
	Mixed	13.96	9.46	67.75	1.23		
	Residual	5.48	3.52	64.23			
D-74	Crusher	15.87	12.81	80.72		176	3616.8
	Mixed	15.74	12.51	79.48	1.12		
	Residual	3.67	2.52	68.67			
Striped	Crusher	13.67	10.00	73.15		141	4244.1
	Mixed	13.84	10.37	74.93	1.17		
	Residual	3.20	2.08	65.00			

TABLE NO. XIII

STERLING TEST FIELD

Mill Tests of Sugar Cane Varieties. (Plant Cane)

(No maceration used on mills)

Sterling Sugars, Inc., Franklin, La. Nov. 22, 1927.

Variety	Juice	Brix %	Sucrose %	Purity %	Pounds 96° Sugar	
					Per Ton	Per Acre
P. O. J. 36	Crusher	17.30	15.15	87.51	183.26	4559.9
	Mixed	16.60	13.98	84.22		
	Residual	16.20	12.96	80.00		
P. O. J. 213	Crusher	17.40	15.41	87.98	202.16	3837.0
	Mixed	17.10	14.79	86.49		
	Residual	16.40	13.25	80.79		
P. O. J. 228	Crusher	16.10	12.86	79.87	143.8	2812.7
	Mixed	14.90	11.86	79.53		
	Residual	14.70	10.98	74.69		
P. O. J. 234	Crusher	18.60	16.59	89.19	209.11	4261.66
	Mixed	17.50	15.10	86.29		
	Residual	17.90	14.97	84.19		
P. O. J. 826	Crusher	16.90	14.15	83.75	192.2	3782.5
	Mixed	16.60	13.85	83.42		
	Residual	16.30	12.98	80.00		
P. O. J. 979	Crusher	17.70	14.80	83.62	175.80	3414.04
	Mixed	17.30	14.17	81.91		
	Residual	17.20	13.90	80.81		
P. O. J. 2379	Crusher	17.50	15.14	86.51	186.4	3802.5
	Mixed	17.10	14.51	84.91		
	Residual	16.50	13.54	82.06		
Purple	Crusher	16.50	14.42	87.73	195.0	2614.9
	Mixed	16.30	14.11	86.56		
	Residual	16.00	13.09	81.81		

Note: Sucrose calculated on extraction shown by each variety, and B. H. E. of 98, using Java formula.

TABLE NO. XIV

RESERVE TEST FIELD

Mill Tests of Sugar Cane Varieties. (Plant Cane)

(No maceration used on mills)

Godchaux Sugars, Inc., Reserve, La. Nov. 26, 1927

Variety	Juice	Brix %	Sucrose %	Purity %	Glucose %	Lbs. 96° Sugar Per	
						Ton	Acre
P. O. J. 36 —	Crusher	14.92	11.60	77.75		131.33	4729.2
	Mixed	14.42	10.84	75.17			
	Residual	14.24	10.10	70.93	1.04		
P. O. J. 213 —	Crusher	15.02	12.33	82.09			
	Mixed	14.62	11.61	79.41			
	Residual	14.14	10.27	72.63	.847	155.9	5857.2
P. O. J. 228 —	Crusher	13.85	10.13	73.14		115.19	4113.4
	Mixed	13.45	9.46	70.33			
	Residual	13.10	8.54	65.19	1.21		
P. O. J. 234 —	Crusher	15.12	12.32	81.48			
	Mixed	15.02	11.76	78.30		147.97	4576.8
	Residual	14.44	10.51	72.78	.769		
P. O. J. 826 —	Crusher	14.15	10.22	72,23		115.91	3549.2
	Mixed	13.75	9.51	79.16			
	Residual	13.20	8.71	65.98	1.08		
P. O. J. 979 —	Crusher	14.45	11.06	76.54		136.78	4171.7
	Mixed	14.15	10.32	72.93			
	Residual	13.60	9.40	69.12	1.20		
P. O. J. 2379 —	Crusher	14.24	10.12	71.07		115.40	3219.6
	Mixed	13.72	9.56	69.68			
	Residual	13.44	8.97	66.67	1.20		
Purple (Sta.) —	Crusher	13.42	10.16	75.71		131.19	3286.3
	Mixed	13.12	9.80	74.70			
	Residual	12.24	9.06	74.02	1.08		
Purple (Plantation —	Crusher	13.32	9.85	73.95		124.19	3002.9
	Mixed	13.12	9.40	71.65			
	Residual	13.04	8.96	68.71	1.00		

Note: Pounds 96 sugar calculated on extraction shown by each variety and B. H. E. of 98 using Java formula

TABLE NO. XV

Available 96° Sugar Yields and Average for the Five Station Test Fields

Variety	Lbs. 96° Sugar	Glenwood	Youngsville	Cinclare	Sterling	Reserve	Average
P. O. J. 36	Per Ton	149.4	172.5	129	183.26	131.33	153.10
	Per Acre	3815.68	6720.60	4353.7	4559.9	4729.2	4835.81
P. O. J. 213	Per Ton	170.7	160.5	154	202.16	155.9	168.65
	Per Acre	4226.53	5501.94	5097.4	3837	5857.2	4904.01
P. O. J. 228	Per Ton	129.5	129.2	122	140.2	115.19	127.94
	Per Acre	3155.92	3865.66	3821	2742.31	4113.4	3553.74
P. O. J. 234	Per Ton	181.5	193.9	158	209.11	147.97	178.10
	Per Acre	3706.23	6656.58	4266	4261.66	4576.7	4693.43
P. O. J. 826	Per Ton	166.5	170.3	109	192.2	115.91	145.10
	Per Acre	3340	4226.84	3150.1	3782.50	3549.2	3497.93
P. O. J. 979	Per Ton	161.6	181.4	137	175.80	136.78	157.89
	Per Acre	3083.43	4781.70	3779.8	3414.04	4171.8	3834.03
P. O. J. 2379	Per Ton	166.8	154.8	116	186.4	115.40	147.88
	Per Acre	3117.49	4368.45	3344.2	3802.5	3219.6	3570.45
Purple	Per Ton		196.8			131.19	163.99
(Sta.)	Per Acre		4418.16			3286.3	3852.23
Purple	Per Ton	167.8	200.6		195	124.19	171.89
(Pltn.)	Per Acre	793.69	6082.19		2614.9	3002.9	3123.42
D-74	Per Ton	183.3		176			179.65
(Sta.)	Per Acre	2197.76		3616.8			2907.28

TABLE NO XVI

Bagasse Analyses of Test Field Varieties

Variety	%	Glenwood	Cinclare	Reserve	Sterling
P. O. J. 36	Sucrose	4.49	2.85	4.53	3.81
	Moisture	52.40	48.90	47.70	52.00
	Fiber	41.62	49.80	....	....
	Fiber—Cane	....	....	14.49	13.25
P. O. J. 213	Sucrose	3.91	2.85	4.39	5.28
	Moisture	49.70	49.60	43.80	53.00
	Fiber	45.11	46.80	....	....
	Fiber—Cane	....	....	13.32	12.54
P. O. J. 228	Sucrose	4.13	....	3.57	3.63
	Moisture	50.00	42.20	43.80	50.00
	Fiber	44.03	....	....	....
	Fiber—Cane	....	....	13.89	15.92
P. O. J. 234	Sucrose	4.23		4.39	5.92
	Moisture	52.75	47.60	48.80	52.00
	Fiber	41.77	48.00		
	Fiber—Cane	....	....	13.84	12.69
P. O. J. 826	Sucrose	4.10	....	3.57	4.88
	Moisture	50.00	51.40	43.50	52.00
	Fiber	44.36	46.00	....	....
	Fiber—Cane	....	....	13.93	10.96
P. O. J. 979	Sucrose	4.03	....	4.11	4.26
	Moisture	51.20	51.10	47.20	53.00
	Fiber	43.30	44.72	....	....
	Fiber—Cane	....	....	11.10	13.86
P. O. J. 2379	Sucrose	4.62	....	3.70	4.11
	Moisture	58.00	55.50	44.80	53.00
	Fiber	35.49	41.68	....	....
	Fiber—Cane	....	....	14.08	13.59
Purple	Sucrose	4.58	....	4.25	4.83
(Plantation)	Moisture	58.50	....	49.50	52.00
	Fiber	35.29	....	....	....
	Fiber—Cane	....	....	10.22	11.82
Purple	Sucrose	....	....	4.25	....
(Sta.)	Moisture	....	....	47.50	....
	Fiber	....	....	....	....
	Fibre-Cane	....	....	11.27	....
D-74	Sucrose	4.53	....	....	....
	Moisture	55.50	57.20	....	....
	Fiber	38.56	36.80	....	....
Striped	Moisture	....	55.60	....	....
	Fiber	....	40.80	....	....

Note: Fiber % Cane calculated. No bagasse analyses were made at Youngsville, due to fermentation of samples.

SUMMARY

In summarizing the work of the Louisiana Experiment Station test fields, it is to be taken in consideration that the results represent the work of a period of one year, under a very favorable season for sugar cane in Louisiana.

At all of the test fields, P. O. J. 234 was the earliest germinating and earliest suckering variety. P. O. J. 213 was the most prolific suckering variety.

In the test field growth measurements at Glenwood, Reserve, and Cinclare, the tallest varieties were as follows: (1) P. O. J. 234; (2) P. O. J. 213; and (3) P. O. J. 36. At Sterling and Youngsville, the first three leading varieties were in the following order; (1) P. O. J. 26; (2) P. O. J. 234; and (3) P. O. J. 213.

From the results of the handmill analyses, P. O. J. 234 was the leading variety, early in the season and throughout the season, in Brix, Sucrose and Purity. In the average handmill analyses of the three released varieties, from the standpoint of highest sucrose, P. O. J. 234 was first, P. O. J. 213 second and P. O. J. 36 third. In the other P. O. J. varieties on trial, P. O. J. 979 made the best showing.

The five Louisiana Experiment Station test fields are located in four representative sections of the sugar belt; (1) river sections, upper west side and lower east side; (2) Bayou Lafourche section: (3) Teche section; and (4) southwestern section; representing the following respective soil types; sandy clay loam, clay loam, Teche sandy clay and Olivier silt loam.

The highest field tonnage yields were obtained on sandy clay loam and Olivier silt loam. While the highest sugar yields per ton were obtained from the Teche clay soil.

At Glenwood, Youngsville, Cinclare and Sterling, P. O. J. 36 was the leading variety from the standpoint of tonnage, while at Reserve P. O. J. 213 was the leading variety, and this variety was also second highest at Glenwood and Cinclare.

P. O. J. Nos. 36, 213 and 234 proved superior to the old varieties; Purple, D-74 and striped, in both tonnage and sugar yields at all of the station test fields. Also excelling the other four P. O. J. varieties on trial.

From the standpoint of highest sugar yield per acre, P. O. J. 213 was first at Glenwood, outyielding Purple by 3432.84 pounds per acre, and D-74 by 2028.77 pounds per acre; at Cinclare, outyielding D-74 by 1480.6 pounds per acre; and at Reserve, outyielding Purple (Station selected), by 2570.9 pounds per acre; while P. O. J. 36 was first at Youngsville and Sterling, out-yielding Purple by 638.41 and 1945.0 pounds per acre respectively. P. O. J. 36 was second highest at Reserve, Cinclare and Glenwood, followed by P. O. J. 234. P. O. J. 234 was the second highest yielding variety at Sterling and Youngsville, followed by P. O. J. 213 at Sterling and Purple at Youngsville.

In the seven P. O. J. varieties on trial at the Station test fields, P. O. J. 234 produced more sugar per ton at Glenwood, Youngsville, Cinclare and Sterling. P. O. J. 213 was first at Reserve followed by P. O. J. Nos. 234 and 979. At Glenwood, Cinclare and Sterling, P. O. J. 213 was second followed by P. O. J. 2379, P. O. J. 979 and P. O. J. 2379 respectively. In comparison with the old varieties, P. O. J. 234 at Glenwood exceeded Purple, but was slightly lower than D-74. At Youngsville, Purple was the highest; at Cinclare, D-74 was the highest; at Sterling P. O. J. 234 was the highest, and at Reserve P. O. J. 213 was the highest.

In the average results of the five Station test fields in available sugar yield per acre, P. O. J. 213 is the leading variety, with the other varieties in the following order: (2) P. O. J. 36, (3) P. O. J. 234, (4) Purple (Station selected), (5) P. O. J. 979, (6) P. O. J. 2379, (7) P. O. J. 228, (8) P. O. J. 826, (9) Purple (Plantation selected), (10) D-74. P. O. J. 213 gave 1051.78 pounds of sugar per acre more than Purple (Station) and 1996.73 pounds per acre more than D-74 (Station).

The three released P. O. J. varieties; 36, 213 and 234, have greatly surpassed the old varieties and other P. O. J. varieties on trial, in actual field tonnage yields and also in total pounds of sugar per acre, and are therefore the best varieties that are now available for Louisiana conditions.

For the alluvial sections, P. O. J. 213 is the outstanding variety, followed by P. O. J. 36 and P. O. J. 234. In the Teche and southwestern sections, P. O. J. 36 made the best showing, followed by P. O. J. Nos. 234 and 213.

From the series of five large mill tests of the test field varieties that were performed, the classification of the varieties from a milling standpoint, taking into consideration hardness of cane and quality of bagasse, is as follows: (1) D74, Purple and Striped; (2) P. O. J. 979; (3) P. O. J. 2379; (4) P. O. J. 234; (5) P. O. J. Nos. 213, 228, and 826; and (6) P. O. J. 36.

From the results of Station test field large mill tests of P. O. J. canes, and the successful milling of P. O. J. Nos. 234, 213, and 36, Cayana and Uba by a number of Louisiana sugar factories during the past two seasons, the three released P. O. J. varieties now extensively grown in Louisiana can be milled successfully.

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Experiment Station, Departments of Entomology and Plant Pathology.

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AGRICULTURAL EXPERIMENT STATIONS

OF THE

LOUISIANA STATE UNIVERSITY AND
AGRICULTURAL AND MECHANICAL COLLEGE

C. T. DOWELL, Dean and Director

BATON ROUGE, LOUISIANA

SUGAR CANE TEST FIELDS AND FERTILIZER DEMONSTRATIONS

BY

C. B. GOUAUX,

Sugar Cane Specialist.

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Introduction.

The results of the sugar cane variety work conducted in the Louisiana sugar belt during the year 1927 on the five test fields of the Louisiana Experiment Station, which are located in representative sections, are presented in Louisiana Bulletin No. 202. In the fall of 1927, the most promising varieties were again planted in five replications of one-twentieth acre plots, giving at each place two series of sugar cane variety plots, viz, (1) Plant Cane; and (2) First Year Stubble. The work performed at the test fields during the past season was somewhat along similar lines as the previous year. During the regular harvesting season, the varieties on trial were carefully harvested under proper supervision, and accurate results of field tonnages and large scale mill tests were obtained. The tables which follow, with the information and summary, give a complete record of the final results for the year 1928.

The special work of sugar cane fertilizer demonstrations on P. O. J. Nos. 36, 213 and 234 plant and stubble, was conducted as an Extension project under County Agent supervison with cooperating sugar planters. The fertilizer materials for this series of demonstrations were donated to cooperating planters by the Chilean Nitrate of Soda Educational Bureau, who cooperated in the work. The plan of three-acre demonstration used in this Extension project, is based on the results of fertilizer work over a period of years on sugar cane carried out by the Louisiana Experiment Station.

SEASONAL CONDITIONS

The year 1928 opened up with a severe freezing spell of about five days duration, during which the temperature dropped to 18 and 19 degrees F., in the sugar cane parishes. These low temperatures did not injure the plant cane, seed cane in the windrow and stubble of P. O. J. varieties.

During the month of January the rainfall was extremely light, and sugar planters were able to make excellent progress with their field work, including such operations as land preparation for corn and soy beans, wrapping of middles and shaving of stubble. The rainfall distribution during the months of February, March, April and May, was fairly good and not excessive, and planters were able to make good headway and complete spring operations under favorable working conditions. The spring season which was unusually early the previous year, was quite late in 1928. There were cold spells and late frosts which extended until after the middle of April. As a result the crop was a little late in getting started.

During the four best growing months: June, July, August and September, the rainfall at the test field stations was as follows:

Test Fields	Rainfall In Inches			
	June	July	August	Sept.
Cinclare	15.33	8.60	9.38	5.16
Glenwood	15.06	8.14	7.40	4.92
Reserve	17.51	3.12	7.80	4.15
Sterling	21.93	10.48	11.04	7.14
Youngsville	6.28	4.21	1.99	4.15

The heaviest rainfall occurred at Sterling, and the lightest at Youngsville. The rainfall during the months of October and November was uniformly light at all places, which was a favorable condition for maturing the cane crop. In the month of December the rainfall was considerably heavier than the two previous months, at all of the field stations except Youngsville.

The first bud-killing freeze of November 25th., extended throughout the sugar cane growing parishes with the exception of St. Mary, and portions of Lafourche, Iberia and Terrebonne. The second freeze of December 9th., completely killed the bud of standing cane throughout the sugar cane belt.

Fall Planting Of Test Fields

As in previous years the planting of the most promising varieties on the test field stations was performed during the month of October, at which time the bulk of the planting for the next crop is generally made on Louisiana plantations. In all cases the varieties were planted on land where a crop of soy beans was turned under in the regular fall land preparation work.

The usual checkerboard system of one-twentieth acre plots, with five replications of each variety was generally used. The new seedlings, which were planted for the first time on the test fields, were planted in from one to three replications, depending upon the quantity of seed cane that was available. The following planting schedule was used in planting the test fields:

Test Field	Planting Dates
Cinclare	Oct. 17, 1928
Glenwood	Oct. 26, 1928
Meeker	Oct. 22, 1928
Reserve	Oct. 25, 1928
Sterling	Oct. 29, 1928
Youngsville	Nov. 3, 1928

On these six Experiment Station test fields, the following varieties were planted: P. O. J. Nos. 36, 36M, 213, 234 and 2725; C. P. Nos. 130, 177 and 807; and Co-281.

Field Data And Mill Test Results Of Station Test Fields

The first year stubble of the five Station test fields was harvested, starting in early November and extending through the latter part of the month. As soon as the stubble cane series was completed, the plant cane plats were harvested in a similar manner, starting in the latter part of November, through December and finishing on January 2, 1929. Both the first year stubble and plant cane series were handled under careful supervision; and special attention was given to the proper harvesting, loading and weighing, so as to obtain separate weights of the plats under replicated conditions. After the field data were thus obtained, the replicated plats of each variety on trial were bunched together in separate piles in the mill yard, as the first preparatory step for the large scale mill tests. This system was used at Glenwood, Sterling and Youngsville; while at Cinclare and Reserve, the varieties were loaded into separate cars and taken directly to the factory. The varieties were milled on a large scale basis in a systematic milling order under proper supervision, and the analytical work was given special attention by the plantation officials and chemists of the cooperating test fields.

The field data and large scale mill test results are presented in the following tables:

TABLE No. 1

Glenwood Station Test Field

Series of First Year Stubble:

Planted Oct. 18-20, 1926. Plant Cane harvested Nov. 18-20, 1927. First Year Stubble harvested Nov. 5-6, 1928.

VARIETY	NORMAL JUICE			TONS PER	LBS. 96° SUGAR	
	Brix	Sucrose	Purity	Acre	Per Ton	Per Acre
P.O.J. 36	14.21	10.76	77.06	19.08	147.00	2804.76
P.O.J. 213	14.36	11.78	81.90	22.60	167.79	3792.05
P.O.J. 228	13.70	10.23	74.77	16.04	139.65	2239.99
P.O.J. 234	15.37	12.72	82.80	13.03	182.25	2374.72
P.O.J. 979	14.60	11.00	75.31	19.58	159.32	3119.49
Purple......................		(Yields too low to obtain any data)				

Soil: Very fine Sandy Loam (First bottom soil).

Series of Plant Cane: Planted Oct. 17-19, 1927. Harvested Dec. 17-18, 1928.

VARIETY	NORMAL JUICE			TONS PER	LBS. 96° SUGAR	
	Brix	Sucrose	Purity	Acre	Per Ton	Per Acre
P.O.J. 36	13.50	9.68	71.69	33.00	127.37	4203.31
36 M.	13.66	10.19	74.61	34.28	137.55	4715.21
P.O.J. 213	12.77	8.93	69.96	38.20	115.61	4416.30
P.O.J. 228	12.48	8.65	69.34	32.16	111.20	3576.19
P.O.J. 234	12.78	9.68	75.76	26.32	131.87	3470.82
P.O.J. 826	12.29	8.79	71.56	32.92	115.50	3802.26
P.O.J. 979	11.08	9.18	70.17	33.93	119.04	4039.03
P.O.J. 2714	11.94	7.60	63.68	25.30	91.61	2317.73
P.O.J. 2725	12.77	8.50	66.60	33.21	106.17	3525.91
P.O.J. 2727	11.89	7.22	60.67	31.50	83.53	2631.20
Purple	12.90	9.04	70.07	16.98	117.12	1988.70

Cooperating with: Glenwood Sugars, Inc., Napoleonville, La.. Parish of Assumption.

Soil Type: Very fine Sandy Loam (First bottom soil).

TABLE No. 2

Cinclare Station Test Field

Series Of First Year Stubble: Planted Oct. 26-27, 1926. Plant Cane harvested Nov. 21-23, 1927. First Year Stubble harvested Nov. 22, 1928.

VARIETY	NORMAL JUICE			TONS PER	LBS. 96° SUGAR	
	Brix	Sucrose	Purity	Acre	Per Ton	Per Acre
P.O.J. 36	14.29	10.63	74.38	16.78	143.21	2403.06
P.O.J. 213	14.68	11.50	78.33	21.80	159.77	3482.99
P.O.J. 228	14.19	10.26	72.33	15.94	135.75	2163.85
P.O.J. 234	15.87	12.85	80.97	15.57	181.92	2832.48
P.O.J. 826	13.55	9.76	72.05	14.21	128.84	1830.82
P.O.J. 979	15.57	11.58	74.37	16.88	156.02	2633.62
P.O.J. 2379	13.95	9.31	66.77	13.34	116.46	1553.58
Striped		(Yields too low to obtain any data).				
D-74		(Yields too low to obtain any data).				

Soil: Very fine sandy loam. (First bottom soil of Alluvial Origin).

Series of Plant Cane: Planted Oct. 13-15, 1927. Harvested Nov. 22, 1928.

VARIETY	NORMAL JUICE			TONS PER	LBS. 96° SUGAR	
	Brix	Sucrose	Purity	Acre	Per Ton	Per Acre
P.O.J. 36	14.76	11.20	75.90	30.87	152.45	4706.13
36 M.	15.93	12.13	76.13	30.45	165.75	5047.09
P.O.J. 213	15.22	12.17	79.94	35.40	171.06	6055.52
P.O.J. 228	15.55	10.29	66.16	29.88	140.07	4185.29
P.O.J. 234	15.97	13.00	81.39	25.02	185.71	4646.46
P.O.J. 826	14.33	9.87	68.85	29.00	126.46	3667.34

P.O.J. 979	15.81	11.38	72.01	30.41	150.15	4566.06
P.O.J. 2714	13.06	8.50	65.06	22.05	104.15	2296.57
P.O.J. 2725	13.99	9.67	69.12	31.95	124.07	3964.04
P.O.J. 2727	14.38	9.78	68.01	28.56	124.09	3544.01
Purple	14.19	10.53	74.21	19.23	141.66	2724.12

Cooperating with: Est. Harry L. Laws, Cinclare, La., Parish of West Baton Rouge.

Soil Type: Very fine Sandy Loam (First bottom soil, of Alluvial Origin).

TABLE No. 3

Reserve Station Test Field

Series of First Year Stubble: Planted Oct. 28, 1926. Plant Cane harvested Nov. 25-26, 1927. First Year Stubble harvested Nov. 8, 1928.

VARIETY	NORMAL JUICE			TONS PER	LBS. 96° SUGAR	
	Brix	Sucrose	Purity	Acre	Per Ton	Per Acre
P.O.J. 36	15.36	11.06	72.00	24.68	145.93	3601.55
P.O.J. 213	14.48	10.79	74.50	28.84	145.52	4196.80
P.O.J. 228	13.60	9.19	67.60	22.30	116.06	2704.20
P.O.J. 234	14.38	11.04	76.80	21.37	151.66	3240.97
P.O.J. 979	14.58	9.91	68.00	24.36	125.70	3062.05
Purple	14.09	9.78	69.40	4.75	125.85	597.79

Soil: Charkey silty clay loam and clay loam (silt loam predominating).

Series of Plant Cane: Planted Oct. 28, 1927. Harvested Nov. 27-29, 1928.

VARIETY	NORMAL JUICE			TONS PER	LBS. 96° SUGAR	
	Brix	Sucrose	Purity	Acre	Per Ton	Per Acre
P.O.J. 36	13.46	8.92	66.30	32.60	111.03	3619.58
36 M.	14.00	9.44	67.40	31.31	118.96	3724.63
P.O.J. 213	13.70	10.08	73.60	35.26	134.92	4757.28
P.O.J. 228	13.16	8.74	66.40	32.35	108.92	3523.56
P.O.J. 234	14.38	10.64	74.00	26.83	142.89	3833.74
P.O.J. 979	14.04	9.21	65.60	32.41	113.73	3685.99
P.O.J. 2714	12.19	7.44	61.00	20.33	86.53	1759.15
P.O.J. 2725	13.11	8.84	67.40	31.18	111.40	3473.45
P.O.J. 2727	13.07	8.08	61.80	27.60	95.03	2622.83
Purple	14.24	10.40	73.00	8.89	142.02	1262.56

Note: The series of first year stubble varieties were fertilized in early April with a side dressing of Ammo Phos, containing 20% nitrogen and 20% Phosphoric acid, at the rate of 200 pounds per acre.

The series of plant cane varieties, in addition to the fall crop of Biloxi Soy Beans and corn stalks turned under, received the treatment of a winter cover crop of Melilotus Indica, which was turned under in the early spring; being scraped off and wrapped in the middles. The growth of this winter legume was comparatively poor.

Cooperating with: Godchaux Sugars, Inc., Reserve, La., Parish of St. John.

Soil Type: Sharkey silty clay loam.

TABLE No. 4

Sterling Station Test Field

Series of First Year Stubble: Planted Nov. 13, 1926. Plant Cane harvested Nov. 22, 1927. First Year Stubble harvested Nov. 14-15, 1928.

VARIETY	NORMAL JUICE Brix	Sucrose	Purity	TONS PER Acre	LBS. 96° SUGAR Per Ton	Per Acre
P.O.J. 36	16.08	12.57	78.19	20.60	174.52	3595.11
P.O.J. 213	15.87	12.80	80.66	20.60	180.82	3724.89
P.O.J. 228	15.89	12.00	75.50	13.03	163.17	2126.11
P.O.J. 234	16.69	12.28	79.58	16.20	172.15	2788.83
P.O.J. 979	17.12	12.91	75.41	17.06	175.41	2992.49
P.O.J. 826	(No Mill Test)			12.90	....	....
P.O.J. 2379	(No Mill Test)			12.52	....	....
Purple	(Yields too low to obtain any data).					

Soil: Sharkey loam.

Series of Plant Cane: Planted Oct. 19, 1927. Harvested Dec. 31, 1928 and Jan. 1st, 1929.

VARIETY	NORMAL JUICE Brix	Sucrose	Purity	TONS PER Acre	LBS. 96° SUGAR Per Ton	Per Acre
P.O.J. 36	15.63	12.25	78.35	30.00	170.26	5107.80
36 M.	15.92	13.11	82.33	25.14	187.27	4707.97
P.O.J. 213	16.40	13.90	84.76	29.38	197.40	5799.61
P.O.J. 228	14.81	10.40	70.22	26.58	134.94	3586.71
P.O.J. 234	17.08	15.03	88.01	24.93	222.07	5536.21
P.O.J. 979	16.69	11.41	68.35	27.57	145.26	4004.81
P.O.J. 2714	12.93	8.07	62.45	21.40	95.75	2049.05
P.O.J. 2725	14.57	10.24	70.31	22.40	132.97	2978.53
Purple	13.89	10.52	75.74	12.14	143.36	1740.39
P.O.J. 2727	14.86	10.53	70.83	27.90	137.50	3836.25

Cooperating with: Sterling Sugars, Inc., Franklin, La., Parish of St. Mary.

Soil Type: Sharkey Loam.

TABLE No. 5

Youngsville Station Test Field

Series of First Year Stubble: Planted Nov. 4, 1926. Plant Cane harvested Nov. 18-20, 1927. First Year Stubble harvested Nov. 7-9, 1928.

VARIETY	NORMAL JUICE			TONS PER	LBS. 96° SUGAR	
	Brix	Sucrose	Purity	Acre	Per Ton	Per Acre
P.O.J. 36	15.30	10.89	71.23	34.56	142.67	4930.68
P.O.J. 213	15.05	10.25	68.10	39.15	130.15	5095.37
P.O.J. 228	14.25	9.64	67.64	29.81	121.80	3630.86
P.O.J. 234	15.40	11.61	75.39	23.46	157.71	3699.88
P.O.J. 979	15.95	11.35	71.16	25.10	148.61	3730.11
Purple	15.55	12.12	77.94	8.02	167.93	1346.80
P.O.J. 826	(No Mill Test)			20.26	....	....
P.O.J. 2379	(No Mill Test)			16.05	....	....

Soil: Olivier Silt Loam.

Series of Plant Cane: Planted Oct. 25, 1927. Harvested Dec. 21-22, 1928.

VARIETY	NORMAL JUICE			TONS PER	LBS. 96° SUGAR	
	Brix	Sucrose	Purple	Acre	Per Ton	Per Acre
P.O.J. 36	14.67	10.17	69.30	37.78	130.74	4939.36
36 M.	15.15	11.26	74.30	34.67	151.66	5258.05
P.O.J. 213	13.22	9.17	69.40	41.34	118.00	4878.12
P.O.J. 228	12.64	7.93	62.70	34.28	94.41	3236.37
P.O.J. 234	14.86	11.46	77.10	30.48	157.79	4809.44
P.O.J. 979	14.57	10.08	69.20	37.58	129.46	4865.11
P.O.J. 2714	11.90	7.06	59.32	25.80	80.06	2065.55
P.O.J. 2725	12.83	8.34	65.04	42.00	102.31	4865.11
P.O.J. 2727	12.70	7.79	61.33	25.50	91.03	2321.26
Purple	13.22	9.09	68.80	22.52	116.25	2617.95

Note: Both series of first year stubble and plant cane varieties were fertilized with a fertilizer mixture of 200 pounds of Nitrate of Soda, containing 15½% nitrogen; and 200 pounds 16% Superphosphate (Acid Phosphate), per acre.

Cooperating with: F. M. Burley and Youngsville Sugar Company, Youngsville, La., Parish of Lafayette.

Soil Type: Olivier Silt Loam.

AVAILABLE 96° SUGAR METHOD OF CALCULATION

In order to have a uniform set of figures, which can be used in a comparable way, the results of all chemical analyses of the test fields were calculated according to the same formula, given below:

$$\frac{X \pm S \text{ X } \left(1.4 - \frac{40}{C}\right) \text{ X } 100}{96}$$

Where S represents sucrose in Normal Juice, expressed in pounds per ton. X equals recoverable 96 test sugar in pounds per ton.

A Boiling House Efficiency of 100% was used.

In figuring Normal Juice, the Brix of the Crusher Juice was multiplied by .965, giving Brix of Normal Juice. The Purity of the Normal Juice was assumed to be equal to the Purity of the Mixed Juice. An assumed Normal Juice Extraction of 75% was used.

OTHER FIELD ACTIVITIES

During the fall and grinding season, field activities were performed along the following lines:

1. Handmill analyses of test field varieties; both plant cane and first year stubble.

2. Observations and field studies of varieties, taking into consideration such factors as: Land treatment; soil types; cultivation; fertilization and weather conditions.

3. Experiments and practical field information on standing and windrowed P. O. J. canes. Data from both handmill analyses, and large scale mill analyses were collected from the different sections of the cane belt.

SUMMARY OF RESULTS OF STATION TEST FIELDS FOR 1928

The sugar cane variety work conducted at the five Louisiana Experiment Station test fields, in the following representative sections of the cane belt: Cinclare, in West Baton Rouge; Glenwood, in Assumption parish; Sterling, in St. Mary parish; Reserve, in St. John parish; and Youngsville, in Lafayette parish; was continued along somewhat similar lines in 1928, as the work of the previous year. The work was on a much larger scale, as there were two series of test field variety plats at each place, viz, (1) first year stubble, and (2) plant cane. These fields have all been successfully harvested under proper supervision, and complete results on field tonnages, chemical data from the large scale mill tests, and agricultural information on the varieties have been obtained.

In field tonnage yields of first year stubble, P. O. J. 213 was the leading variety at the five Station test fields, followed by P. O. J. Nos. 36 and 979. While in the plant cane series P. O. J. 213 again topped the list except at Sterling, where P. O. J. 36 was slightly higher.

The yield in sugar per ton results show that in both plant cane and stubble, P. O. J. 234 is the leading variety, except in one instance being exceeded at Glenwood by 36 M. P. O. J. 234 duplicated its performance of last year, and again demonstrated its early maturing and high sucrose qualities. Both P. O. J. 234 and 36, as stubble, give very good promise of being richer in sucrose earlier in the season than the plant cane of these varieties, and also of comparing favorably with P. O. J. 234 plant cane. Of the two varieties, P. O. J. 213 was slightly higher at Glenwood, Cinclare and Sterling; while at Reserve and Youngsville, P. O. J. 36 was a little better.

The four leading varieties from the standpoint of highest sugar per acre yield are in the following order for first year stubble: (1) P. O. J. 213; (2) P. O. J. 36; (3) P. O. J. 979; and (4) P. O. J. 234.

In the highest sugar per acre yield, the varieties of the plant cane series are in the following order: (1) P. O. J. 213; (2) 36 M.; (3) P. O. J. 36; (4) P. O. J. 234 and (5) P. O. J. 979.

The variety 36 M. plant cane, made a very promising showing at all of the test fields. In every case it was higher in sugar per ton than P. O. J. 36, and compared favorably with P. O. J. 213 at Cinclare and Sterling; and exceeded this variety at Glenwood and Youngsville; while at Reserve the P. O. J. 213 variety made a better showing. In sugar per acre, 36 M. also made a fine record; especially at Glenwood and Youngsville, where it was at the head of the list; while at Cinclare and Reserve it surpassed P. O. J. 36. At Sterling, due to lighter field tonnage, it was surpassed by P. O. J. 36.

The 27 series consisting of P. O. J. Nos. 2714, 2725 and 2727, all large diameter canes, made a comparatively poor showing at all test fields from the standpoints of field tonnage, sugar per ton and sugar per acre yields. These varieties proved to be later maturing, and more susceptible to the affects of cold weather than P. O. J. 36, 36 M., 213 and 234. P. O. J. 2714 made the poorest showing, being an extremely low sucrose variety. P. O. J. 2725 made the best showing in the 27 series, being the leading variety at all of the test fields except Sterling, where it was exceeded by P. O. J. 2727. The P. O. J. 2727 was the most susceptible to "top rot" disease; the heaviest infestation occurring at Youngsville.

The Glenwood test field plant cane series was harvested after the bud and eye killing freeze of December 9th, on December 17-18th. The standing cane of all of the varieties, including the 27 series, P. O. J. 213, 228, 234, 826 and 979 and Purple, were showing considerable deterioration, while P. O. J. 36 and 36 M. were showing less deterioration from the effects of the freeze.

At the Sterling test field, the plant cane series harvested on December 31, and January 1, 1929, showed very little deterioration. P. O. J. Nos. 228, 979, 2714, 2725 and

2727 and Purple, showed more injury from the freeze; while P. O. J. 36, 36 M., 213 and 234, all made an excellent showing.

The plant cane series of the Youngsville test field was also harvested after the freeze of December 9th, on December 21-22nd. The 27 series, Purple, P. O. J. 228, 979 and 213 showed considerable deterioration; while P. O. J. 36, 36 M. and 234 made a good showing.

In the numerous examinations of fields of standing cane following freezes, where the bud and eyes were carefully inspected, P. O. J. 36 showed greatest resistance to low temperatures; P. O. J. 213 was next in order followed by P. O. J. 234. P. O. J. 228, 826, 979, 2714, 2725, 2727 and Purple, showed considerably more damage from the freeze of November 21st, than P. O. J. 36, 213 and 234.

On the first year stubble series of test fields in the alluvial section, Glenwood and Cinclare received no fertilizer treatment, while at Reserve fertilizer was applied in the form of Ammo-Phos, containing 20% nitrogen and 20% phosphoric acid, at the rate of 200 pounds per acre. In every case all of the varieties on both Glenwood and Cinclare, produced less tons per acre respectively than Reserve, as given below:

P.O.J. 36	5.60 and 7.90 tons per acre
P.O.J. 213	6.24 and 7.04 tons per acre
P.O.J. 228	6.26 and 6.36 tons per acre
P.O.J. 234	8.34 and 5.80 tons per acre
P.O.J. 979	4.78 and 7.48 tons per acre

At Youngsville, both plant cane and stubble received fertilizer, and the tonnage yields of both are exceedingly high, while the sucrose and purities are abnormally low for this section. It seems that both fields received excessive amounts of nitrogen, which had a tendency to prolong the growth, and thereby interrupting the proper maturity of the cane.

In considering the merits of P. O. J. 36, which ranks second to P. O. J. 213 from the standpoint of sugar per acre, this variety made the best showing at the five test fields in the order given: (1) Youngsville; (2) Glenwood; (3) Sterling; (4) Reserve; and (5) Cinclare. In the plant cane series of 1927, P. O. J. 36 made the best showing at Youngsville and Sterling, and was the second highest variety at Reserve, Cinclare and Glenwood.

The three noble-type canes, Purple, Striped and D-74, which were the standard field varieties in Louisiana until 1925, made a complete failure as first year stubble on the Station test fields; while the two leading varieties, P. O. J. Nos. 213 and 36, averaged 26.60 and 23.14 tons per acre respectively. In the plant cane series, P. O. J. Nos. 36, 213 and 234, and some of the unreleased varieties: 36 M., 228, 979 and 2725; greatly surpassed the Purple cane in both yield in tons per acre and yield in sugar per acre.

P. O. J. 213 which is the leading variety from the standpoint of highest yield of sugar per acre, in the average of the five test fields gave 19.96 tons per acre more than the Purple as plant cane. This variety in the average results exceeded P. O. J. 234, which ranked fourth in both the plant and stubble series classification, by 8.68 tons per acre in first year stubble and 9.21 tons per acre in the plant cane series. Also in the average results of first year stubble, P. O. J. 213 outyielded P. O. J. 36, second ranking variety, by 3.46 tons per acre; and P. O. J. 979, third ranking variety, by 6.01 tons per acre. In the average results of the plant cane series, 36 M. occupies second place, P. O. J. 213 exceeded this variety by 4.74 tons per acre, and P. O. J. 36 by 3.06 tons per acre. Although P. O. J. 36 showed slightly higher field yields than 36 M., the latter exceeded the former in sugar per ton at all test fields, and excelled in yield of sugar per acre at all places except Sterling; thereby giving 36 M. the place of second highest variety in the plant cane series.

The variety P. O. J. 213 in two years' results of test field work has been the leading and outstanding cane; proving to be the best all around and most adaptable cane in all of the different sections of the Louisiana sugar belt. In addition it is an excellent variety from both the plant cane and ratooning standpoints ,and the records show that it has surpassed all varieties in actual yields of sugar per acre.

THREE ACRE FERTILIZER DEMONSTRATIONS ON P. O. J. CANES

Table No. 6

First Year Stubble

FERTILIZER TREATMENT

No.	Planter	Parish	County Agent	Variety	200#NS 200#AP				CHECK				300#NS 200#AP			
					Tons Per A.	Brix	Suc.	Pur.	Tons Per A.	Brix	Suc.	Pur.	Tons Per A.	Brix	Suc.	Pur.
1.	**Glenwood**	Assumption	H. Lesseps	P.O.J. 234	17.96	15.94	13.51	84.76	14.56	16.81	14.36	85.43	17.29	16.02	13.24	82.7
2.	**A. M. Foley**	Ascension	C. C. Chapman	P.O.J. 234	16.17	16.50	13.40	81.20	13.22	16.00	13.20	82.50	18.44	16.70	13.40	80.30
3.	**Picard**	Ascension	C. C. Chapman	P.O.J. 234	15.08	16.30	12.80	80.70	14.10	16.10	12.50	81.60	17.05	16.50	12.90	80.90
4.	**H. Bubenzer**	Rapides	F. A. Swann	P.O.J. 234	21.16	....	....	....	17.75	....	....	....	26.65	....	....	....
5.	**Peebles**	Iberia	R. V. St. Dizier	P.O.J. 234	9.23	....	....	....	5.94	....	....	....	11.13	....	....	....
6.	**L. J. Landry**	Iberia	R. V. St. Dizier	P.O.J. 234	9.88	15.05	12.30	81.70	11.86	14.47	12.33	85.20	14.98	12.56	9.79	77.90
7.	**Southdown**	Terrebonne	J. G. Richard	P.O.J. 213	28.61	16.08	12.76	79.37	22.74	15.31	12.09	78.97	27.39	15.55	12.15	78.15
8.	**McCollam**	Terrebonne	J. G. Richard	P.O.J. 234	22.04	....	....	....	12.91	....	....	....	19.78	....	....	....
9.	**O. J. Mire**	Lafourche	V. A. Guidroz	P.O.J. 234	17.36	17.20	14.93	86.80	13.26	17.80	15.88	89.20	23.27	17.60	15.53	88.24
10.	**W. C. Morvant**	Lafourche	V. A. Guidroz	P.O.J. 234	18.47	18.00	16.12	89.56	11.25	18.35	16.33	88.99	19.14	18.05	15.83	87.70
11.	**Bowie**	Lafourche	V. A. Guidroz	P.O.J. 234	12.83	16.64	12.48	75.00	8.19	16.78	13.85	82.54	13.62	16.03	12.29	76.67
12.	**Waterford**	St. Charles	G. W. Bohne	P.O.J. 213	14.42	....	....	....	8.52	....	....	....	15.81	....	....	....
13.	**Waterford**	St. Charles	G. W. Bohne	P.O.J. 234	15.85	17.20	15.00	87.20	9.26	17.40	15.00	86.10	19.25	16.70	14.40	86.30
14.	**Longview**	St. James	R. C. Callaway	P.O.J. 234	14.59	16.13	12.83	79.54	13.30	16.42	12.89	78.50	17.79	15.95	12.35	77.42
15.	**Miles**	St. James	R. C. Callaway	P.O.J. 234	18.33	16.97	13.88	81.80	13.22	16.98	14.22	83.75	19.47	16.27	13.50	82.97
16.	**Yokely**	St. Mary	E. S. Landry	P.O.J. 234	12.83	....	....	....	8.00	....	....	....	12.15	....	....	....
17.	**Burley**	Lafayette	F. M. Bacque	P.O.J. 36	34.00	....	....	....	30.00	....	....	....	36.20	....	....	....
18.	**Smithfield**	W. B. R.	A. E. Camus	P.O.J. 234	21.23	15.90	13.30	83.60	14.22	16.03	13.75	85.90	18.27	17.16	14.38	83.20
19.	**H. Wilkinson**	W. B. R.	A. E. Camus	P.O.J. 234	20.00	15.10	12.25	83.20	16.00	15.75	12.85	84.21	21.50	16.01	13.15	83.60

Louisiana State University Extension Service Cooperating with
Chilean Nitrate of Soda Educational Bureau.

NOTE:—NS equals Nitrate of Soda, 15½% Nitrogen.
AP equals Acid Phosphate, 16% available Phosphoric Acid.

THREE ACRE FERTILIZER DEMONSTRATIONS ON P. O. J. CANES

Table No. 7

First Year Stubble

No.	Previous Treatment of Land 1926	1927	Increased Yield Due to 200#NS 200#AP Over Check Tons Per A	Net Profit	Increased Yield Due to 200#NS 200#AP Over Check Tons Per A	Net Profit
1.	Corn & Soy Beans Under	No Fertilizer	3.40	$ 3.72	2.73	$ 0.63
2.	Corn & Soy Beans Under	No Fertilizer	2.95	2.37	5.22	6.84
3.	Corn & Soy Beans Under	No Fertilizer	.98	— 3.54	2.95	0.03
4.	Corn & Soy Beans Under	No Fertilizer	3.41	3.75	8.90	17.88
5.	Corn & Soy Beans Under	No Fertilizer	3.29	3.39	5.19	6.75
6.	Corn & Soy Beans Raked	Same Fertilizer	—1.98	— 6.48	3.12	0.54
7.	Corn & Soy Beans Under	No Fertilizer	5.87	11.13	4.65	5.13
8.	Corn & Soy Beans Under	No Fertilizer	9.13	20.91	6.87	11.79
9.	Corn & Soy Beans Raked	No Fertilizer	4.10	5.82	10.01	21.21
10.	Corn & Soy Beans Raked	No Fertilizer	7.22	15.18	7.89	14.85
11.	Corn & Soy Beans Raked	No Fertilizer	4.64	7.44	5.43	7.47
12.	Corn & Soy Beans Under	No Fertilizer	5.90	11.22	7.29	13.05
13.	Corn & Soy Beans Under	No Fertilizer	6.59	13.29	9.99	21.15
14.	Corn & Soy Beans Under	No Fertilizer	1.29	— 2.61	4.49	4.65
15.	Corn & Soy Beans Under	No Fertilizer	5.11	8.85	6.25	9.93
16.	Corn & Soy Beans Raked	Same Fertilizer	4.83	8.01	4.15	3.63
17.	Corn & Soy Beans Under	Same Fertilizer	4.00	5.52	6.20	9.78
18.	Corn & Soy Beans Under	No Fertilizer	7.01	14.55	4.05	3.33
19.	Corn & Soy Beans Under	No Fertilizer	4.00	5.52	5.50	7.68

Soil Types: Nos. 1, 2, 3, 7-15 inc., 18 and 19, Alluvial Soils; Nos. 5 and 6, Iberia Clay Loam. No. 16, Teche Clay Loam; No. 17, Oliver Silt Loam.

NOTES:—Cost of Fertilizer: 200#NS 200#AP, $6.48 Per Acre. 300#NS 200# AP, $8.82 Per Acre. Cost of Harvesting, Loading & Hauling Cane: $1.00 Per Ton. Price of Cane: $4.00 Per Ton.

Louisiana State University Extension Service Cooperating with Chilean Nitrate of Soda Educational Bureau.

THREE ACRE FERTILIZER DEMONSTRATIONS ON P. O. J. CANES

Table No. 8

Plant Cane

					FERTILIZER TREATMENT											
					200#NS 200#AP				CHECK				300#NS 200#AP			
No.	Planter	Parish	County Agent	Variety	Tons Per A.	Brix	Suc.	Pur.	Tons Per A.	Brix	Suc.	Pur.	Tons Per A.	Brix	Suc.	Pur.
1.	Burdin	E. B. R.	G. C. Smith	P.O.J. 213	39.60	....	....	....	41.30	....	....	....	43.70	....	....	....
2.	Comeaux	Lafayette	F. M. Bacque	P.O.J. 234	24.38	....	....	....	23.00	....	....	....	23.98	....	....	....
3.	Drouet	Rapides	W. E. Simmons	P.O.J. 234	24.50	16.80	14.50	84.70	17.76	16.10	13.42	83.40	20.50	16.60	14.02	84.50
4.	Ruth	St. Martin	J. G. Nargassans	P.O.J. 234	19.42	17.04	13.95	81.80	17.79	17.04	14.53	85.20	20.44	16.56	13.68	82.60
5.	Singleton	St. Martin	J. G. Nargassans	P.O.J. 213	25.08	15.94	12.03	75.50	26.88	16.96	13.11	82.10	29.31	15.56	12.64	81.20
6.	Smedes	St. Martin	J. G. Nargassans	P.O.J. 234	19.22	17.26	14.73	85.30	20.12	17.32	14.73	85.00	20.00	16.92	13.98	82.60
7.	Cinclare	W. B. R.	A. E. Camus	P.O.J. 234	27.44	15.90	13.30	83.60	25.16	16.03	13.75	85.90	26.43	17.16	14.38	83.80
8.	Durke	Vermilion	J. D. Sobert	P.O.J. 213	25.99	15.40	11.86	77.00	19.69	15.00	11.96	79.60	33.55	14.60	11.71	80.25
9.	Broussard	Vermilion	J. D. Sobert	P.O.J. 213	34.27	14.39	10.92	75.80	26.10	14.49	11.02	76.20	33.52	14.69	11.24	76.70
10.	Erath	Vermilion	J. D. Sobert	P.O.J. 213	21.60	15.01	11.64	77.50	18.05	16.21	13.28	81.70	21.76	15.27	11.95	79.30

Louisiana State University Extension Service Cooperating with Chilean Nitrate of Soda Educational Bureau.

NOTE:—NS equals Nitrate of Soda, 15½% Nitrogen.
AP equals Acid Phosphate, 16% available Phosphoric Acid.

THREE ACRE FERTILIZER DEMONSTRATIONS ON P. O. J. CANES

Table No. 9

Plant Cane

No.	Previous Treatment of Land 1926	1927	Increased Yield Due to 200#NS 200#AP Over Check Tons Per A	Increased Yield Due to 200#NS 200#AP Over Check Net Profit	Increased Yield Due to 300#NS 200#AP Over Check Tons Per A	Increased Yield Due to 300#NS 200#AP Over Check Net Profit
1.	First Year Stubble	Corn & Soy Beans Under	— 1.70	— $ 6.48	2.40	— $ 1.62
2.	First Year Stubble	Corn & Soy Beans Under	1.38	— 2.34	.98	— 5.88
3.	First Year Stubble	Corn & Soy Beans Under	6.74	13.74	2.74	— .60
4.	First Year Stubble	Corn & Soy Beans Under	1.63	— 1.59	2.65	— .87
5.	First Year Stubble	Cowpeas Under	— 1.80	— 6.48	2.43	— 1.53
6.	First Year Stubble	Corn & Soy Beans Under	— .90	— 6.48	— .12	— 8.82
7.	Corn & Soy Beans Under	Corn & Soy Beans Under	2.28	.36	1.27	— 5.01
8.	First Year Stubble	Corn & Soy Beans Raked	6.30	12.42	13.86	32.76
9.	First Year Stubble	Corn & Soy Beans Raked	8.17	18.03	7.42	13.44
10.	First Year Stubble	Corn & Soy Beans Under	3.55	4.17	3.71	2.31

Soil Types: Nos. 1, 4, 5, and 7, Alluvial Soils. Nos. 2 and 6, Silt Loam. No. 3, Red River Sandy Clay Loam. Nos. 8, 9 and 10, Crowley Silt Loam.

NOTES:—Cost of Fertilizer: 200#NS 200#AP, $6.40 Per Acre. 300#NS 200#AP, $8.82 Per Acre.
Cost of Harvesting, Loading and Hauling Cane: $1.00 Per Ton. Price of Cane: $4.00 Per Ton.

Louisiana State University Extension Service Cooperating with Chilean Nitrate of Soda Educational Bureau.

SUMMARY OF RESULTS OF FERTILIZER DEMONSTRATIONS ON P. O. J. CANES FOR SEASON OF 1928

During the season of 1928, numerous series of fertilizer demonstrations were conducted throughout the sugar belt, on both plant cane and first year stubble of P. O. J. Nos. 36, 213 and 234. The results of these demonstrations are for a one-year period, under fairly representative growing conditions for Louisiana.

"Three Acre Fertilizer Demonstrations on P. O. J. Canes." Tables Nos. 1 and 2, First Year Stubble. Nos. 1, 2, 3, 7-15 inc., 18 and 19. Alluvial Soils.

The fourteen demonstrations, which received 200# Nitrate of Soda and 200# Superphosphate per acre, showed an averaged increase of 4.87 tons per acre, and $8.13 net profit per acre. A loss was shown in two cases.

On Iberia Clay Loam, No. 5, gave an increase over check, and a net profit; while No. 6, which was treated with the same fertilizer mixture the year previous was unprofitable.

The demonstrations on alluvial soils, where the treatment was 300# Nitrate of Soda and 200# Superphosphate, showed an average gain of 5.95 tons per acre, and $9.15 net profit per acre.

Demonstration No. 16, on Teche clay loam, treated with 200# Nitrate of Soda and 200# Superphosphate, showed a marked increase over the check; being slightly higher than the heavier application.

The demonstrations show that on first year stubble of P. O. J. canes, that applications of 200# Nitrate of Soda to 300# Nitrate of Soda or its equivalent in readily available nitrogenous material, and 200# 16% superphosphate per acre, gave an average increase of 5.41 tons per acre and a net profit of $8.64 per acre.

Tables Nos. 8 and 9, Plant Cane.

The demonstrations Nos. 1, 4, 5 and 7, on alluvial soils, all show negative results for both fertilizer mixtures; indicating that it is unprofitable to fertilize plant cane, following a legume (soy beans) turned under.

Demonstrations Nos. 2 and 6, on silt loam, also showed negative results.

Demonstration No. 3, Red River sandy clay loam, showed a marked increase over check and high net profit for the 200# Nitrate of Soda and 200# Superphosphate treatment; while the heavy application showed a loss.

The Crowley Silt loam demonstrations, Nos. 8, 9 and 10, gave an average of 7.23 tons per acre and $15.22 net profit for the 200# Nitrate of Soda and 200# Superphosphate treatment; and 10.64 tons per acre and $23.10 net profit for the 300# Nitrate of Soda and 200# Superphosphate treatment.

The results of the plant cane demonstrations on alluvial sandy clay loam soil, confirm the recommendations of the Experiment Station, showing that it is unprofitable to fertilize plant cane on lands where a good crop of soy beans has been turned under. On the Red River sandy clay loam soil, the results show a profit with one of the fertilizer treatments. The results of the three plant cane fertilizer demonstrations conducted on Crowley silt loam in Vermilion parish, show very positive returns for 1928, and similar positive results were secured on plant cane in 1927.

ACKNOWLEDGMENTS

W. G. Taggart, Asst. Director, L. S. U. Experiment Station.
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Godchaux Sugars, Inc., Reserve, La.
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Meeker Sugar Co., Meeker, La.
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A. M. O'Neal, U. S. Sugar Plants Station, Houma, La.

MARCH, 1930 LOUISIANA BULLETIN No. 204

REPORT OF THE NORTH LOUISIANA EXPERIMENT STATION FOR THE YEARS 1928-1929

BY

SIDNEY STEWART

LOUISIANA STATE UNIVERSITY
AND
AGRICULTURAL AND MECHANICAL COLLEGE
AGRICULTURAL EXPERIMENT STATIONS

C. T. DOWELL, Dean and Director

FOREWORD

I have asked each of the Superintendents of the substations to write a narrative report of the work done at his station during the last two years. You will notice that no tables are given. The details in regard to the different experiments will be reported later in bulletin form, at the time of the completion of the project or at definite stages in the progress of the project.

I think the farmers are more interested in the purpose of the project and the results obtained than they are in the details. It is for that reason that I have had the reports written in this form.

C. T. DOWELL, Dean and Director

1928-1929 REPORT

OF THE

NORTH LOUISIANA EXPERIMENT STATION, CALHOUN, LOUISIANA.

This Station is located in Ouachita Parish, fourteen miles west of Monroe, on the Dixie-Overland Highway and on the Y. & M. V. railroad.

Three areas, not included in the experimental program, consisting of eighteen, fourteen and eighteen acres respectively, are used for producing the necessary feed for the place and for the general cotton crop. A three year rotation is practiced, with cotton, corn and velvet beans, and corn with soy beans. Cost records are kept, from preparation of soil for planting, to harvesting. No land rent is deducted from the figures given below, which are the results for the past three years:

	Cost of production and harvesting: (Average)	Yield per acre: (Average)	Profit per acre (Average)
Cotton	$49.55	1362 pounds	$45.79
Corn	18.49	18.95 bushels	.46

A minimum production of 18 bushels per acre is necessary in order to realize a profit on a corn crop.

The cotton seed are handled carefully, ginned on cleaned gins and after being sacked in even weight 100 pound bags, are sold at less than breeder prices. For the past two years D & P L No. 4 cotton has been used, but for the coming season D & P L No4-8 will be planted, as it has a higher lint percentage, practically the same length staple, equally as prolific and easier to harvest.

SOIL INVESTIGATION.

Three Year Manure Rotation

The purpose of this test is to determine the effect on crop production and the mechanical condition of the soil, of a three year rotation, (corn and cowpeas, oats followed by cowpeas, and cotton), in which stable manure and certain commercial fertilizers are applied to a certain part of the plots.

This is a modification of the original Compost work, begun 1889, in which a compost, composed of stable manure, green cotton seed and acid phosphate, was applied to half of each plot. The compost is now omitted, and stable manure is applied at the rate of 10 tons per acre broadcast and disced in; 225 pounds of Superphosphate and 75 pounds of Nitrate of Soda, per acre, are applied in the drill prior to planting. These amounts are considered equivalent in plant food to the material used in the compost.

Immediately after harvesting the corn crop, the stalks are cut and, with the peavines are turned under. The plot is seeded to oats, early in October. Immediately after harvesting the oats, cowpeas are drilled in, in narrow rows and cultivated. After the peas are harvested for seed the vines are turned under. The third year, the plot is planted to cotton. The land devoted to this work consists of three plots of 1.44 acres each, designated as Plots A, B & C respectively.

Results for the past two years are given in the table below:

RESULTS FOR 1928.

	South Half Fertilized two years of each three, with manure and commercial fertilizer.	Northeast ¼ Fertilized two years of each three with 200 lbs. Superphosphate.	Northwest ¼ Has received no fertilizer since beginning of experiment
PLOT "A" Cotton	728 pounds per acre	550 pounds per acre	261 pounds per acre
PLOT "B" Corn	25.73 bushels per acre	14.76 bushels per acre	13.36 bushels per acre
PLOT "C"			
Oats (Per acre)	10.57 bushels	11.25 bushels	10.12 bushels
Peas " "	6.74 "	5.92 "	3.28 "

RESULTS FOR 1929

PLOT "A" Corn	26.17 bushels per acre	12.94 bushels per acre	6.50 bushels per acre
PLOT "B" Oats	23.04 bushels per acre	17.52 bushels per acre	14.16 bushels per acre

(On account of extremely dry weather, during blooming period, the peas failed to mature seed. Vines turned under.)

PLOT "C" Cotton	1039 pounds per acre	874 pounds per acre	304 pounds per acre

Cotton Fertilizer Test

To determine the most profitable amounts of commercial fertilizer for cotton production, is the purpose of this test. It is being conducted on land typical of this section of the state, but is in a slightly higher state of fertility.

Three rows, 100 feet long, are used, with the fertilizer applied previous to planting, to the second and third rows of each plot. Four replications are used.

In the first five plots, the amounts of Nitrate of Soda and Kainit are constant, being 150 pounds and 100 pounds per acre respectively, with Superphosphate applied in amounts from none up to 600 pounds per acre, by 150 pounds units.

The Nitrate of Soda is the variable in the next six plots, being increased 50 pounds per acre in each plot, from none up to 300 pounds per acre, the amounts of Superphosphate and Kainit being constant at 300 pounds and 100 pounds per acre respectively.

Kainit in varying amounts from nothing up to 250 pounds per acre, is the variable in the last five plots, the amounts being increased in each plot by 50 pounds. Superphosphate and Nitrate of Soda are constant at 300 and 100 pounds per acre, respectively, in each group.

Check plots are grown between the groups for securing comparative yields.

In 1929 the largest gain in yield from any food element, was from potash, with the basic amounts of nitrogen and phosphoric acid, which is in accordance with the 1928 results, but in contrast to the 1927 results, when no benefits resulted from the use of potash.

The lowest yield in 1929 was from a O-16-6, at the rate of 350 pounds per acre, while the highest was from the use of 575 pounds of a 4-10-10 mixture. It is very probable that the use of about 600 pounds of a 7-10-4 should prove most profitable for the hill region of the state.

SOURCE OF NITROGEN TEST. COTTON

By combining different nitrogenous fertilizers with Superphosphate and Kainit, it will be determined what combinations affect most the yield of seed cotton per acre. The test is being conducted on soil to which no nitrogenous fertilizer has been applied within the past four years.

Three hundred pounds of Superphosphate and 100 pounds of Kainit, per acre, are used with each combination. Thirty pounds of nitrogen per acre, are supplied in the following materials.—Nitrate of Soda; Nitrate of Soda and Cotton Seed Meal; Cotton Seed meal alone; Leuna Salpeter; Cal-Nitro; Cyanamid; Sulphate of Ammonia; Sulphate of Ammonia and Nitrate of Soda.

The unfertilized check yielded at the rate of 790 pounds of seed cotton. The highest, 1680 pounds per acre, was from a combination of Nitrate of Soda and Cotton seed meal; second, Cal-Nitro, 1545; third, Leuna-salpeter, 1500, fourth, Nitrate of Soda and Sulphate of Ammonia, 1380, while the lowest was from Cyanamid, yielding at the rate of 1275 pounds.

SOURCE OF NITROGEN TEST, CORN

The same materials were used in the corn test, as in the cotton test, one half of the nitrogen and all the other fertilizer applied previous to planting, the balance used as a side dressing while the corn was about waist high.

A combination of Nitrate of Soda and Sulphate of Ammonia gave the highest yield, 35.57 bushels per acre; second, Nitrate of Soda and C. S. Meal, 33.86; third, Nitrate of Soda, 33.43. The lowest yield, Cyanamid, 25.71 bushels. The unfertilized check yielded at the rate of 14.57 bushels per acre.

WINTER COVER CROPS:

In 1928, Austrian Winter Peas were planted in 24 inch drills, Nov. 22nd., in a slight depression. A good stand was secured and good growth was made by April 10th. 1929. A yield of 18.1 tons per acre green matter was taken from the plot, which when thoroughly cured out was at the rate of 2.25 tons hay per acre. This was a shrinkage of 89%.

Further work is being done with this plant, under a better system, by which more definite results can be determined, as to its value as a source of nitrogen for subsequent crops and as a general soil builder. On account of its hardiness it is expected to prove of benefit to soils of this type.

CLOVERS.

Seven varieties of clovers, Hairy Vetch, Austrain Peas, Rye and Oats were each planted in separate plots, Nov. 29th.,1929. Four replications of the clovers and three of the other crops were secured. On account of the late planting date, the cold weather of Dec. 21st., killed all of the clovers. The other crops, including the vetch and peas were killed to the ground, but have since made new growth and will probably survive the winter. New plantings of the clovers will be made during February. Later plantings of the same varieties were made in the Pecan Orchard and had not germinated at the time the others were killed and seen to be in shape to pull through the winter.

All of the Pecan Orchard has had an application of lime at the rate of 2 tons per acre, while the clover plot has lime on the south half, at the same rate.

ORCHARD.

In 1923, a model Home Orchard was planted on two acres, consisting of several varieties of peaches, apples, plums, pears and figs. On account of the poor equipment for handling insect pests and scale, several of the trees have died and none of them has made very satisfactory growth. For the past two years, the orchard has been fairly well cultivated. The vacancies are being filled and a new orchard, in addition to the other, of summer apples, is being put in. A new "Friend" power spraying machine has been placed here, with which the trees can be thoroughly protected. The regular spray schedule will be followed, both dormant and during the summer.

PECANS.

The pecan orchard includes 17 varieties, none of which has made heavy yields, on account of the poor condition of the trees, from scale damage. This can be overcome by the generous use of the power spray. The varieties seeming to be best suited to local conditions are; Moneymaker, Stuart, Schley, Success and possibly Frotschers.

COTTON VARIETY TEST.

Twenty or more varieties and strains of cotton are planted in one-row plots, with six replications. The plots are treated with a moderate application of a complete fertilizer given clean cultivation during the growing season and protected from boll weevil damage by treatments of Calcium Arsenate.

The following observations are recorded: Number of bolls per pound, lint percentage, yield of lint per acre, length of staple, value of staple, value of lint and seed per acre.

While the soil of the Experiment Station, as a whole, is typical North Louisiana hill land, the plots used for these tests are fairly level and more fertile than the average.

The results obtained the past three years show high rank for certain staple varieties. It is probable though that on the poorer lands of the section, and most of the land is less fertile, that a more vigorous growing short staple cotton will be most profitable. Delfos No. 2 and Express 317 are among the most vigorous growing of the staple varieties. Dixie Triumph is a good variety to grow on land where cotton rusts and wilts badly. D & P L No. 4-8 is a good hill land variety, as it has good length for a short cotton, has a good lint percentage and is fairly disease resistant, and productive.

COTTON BREEDING.

In order to develop a variety of cotton most satisfactory for North Louisiana hill conditions, individual plant selections are made in the fields, from varieties now grown. These selections are grown in progeny rows and in strain tests and the most promising strains are increased in isolated fields. When a sufficient amount of seed has accumulated, they are distributed to growers.

COTTON DUSTING, FOR WEEVIL CONTROL.

In order to determine the profitableness of dusting with Calcium Arsenate, for the control of Boll Weevils in cotton, four 10 row plots, 420 feet long, alternated with check plots of similar area, are used. Calcium Arsenate is applied at the rate of 8 or 10 pounds per acre, with dust guns, when the infestation reaches approximately 10%. This treatment is repeated at four day intervals until three successful applications have been made. Later applications are made if necessary.

The 1928 results show a profit, above cost of dusting, of $14.10 per acre, while the results for 1929 are $6.26 per acre.

COTTON, FOLLOWING CORN AND SOY BEANS.

In order to determine the effect of soy beans on the yield of corn, and the subsequent yield of cotton following corn and soy beans, one plot of 1.4 acres is planted to corn and soy beans. Three rows are planted to corn and soy beans in four or more replications, alternating with similar plots of corn alone. Cotton is planted over the entire area the second year, in rows identical with the original rows. Results are obtained from the center row of each plot.

After 1929, five rows to each plot will be used instead of three-row plots, by which the chance of cross-feeding will be lessened.

Results for the past two years are as follows:

	Bushels per acre	
	1928	1929
Corn alone	19.5	28.36
Corn, with beans	16.07	24.6

The 1929 crop was grown on a different plot, which being better soil and with better seasons, produced at a higher rate. Cotton, following corn with and without beans was:—

Cotton, after corn alone produced 1050 pounds per acre; following beans in corn rows, 1295 pounds per acre. Three hundred pounds of Superphosphate per acre was the only fertilizer supplied in growing the crop. Only one year's results are available.

CORN VARIETY TEST.

Twelve varieties of corn were planted in one row plots in 1928 and eighteen varieties in 1929, to determine the type and varieties most suitable for use in this type soil. All of the plots are well fertilized, planted at the same time and given identical treatment during the growing season. Seven replications are made and comparative results of yields of grain per acre are obtained.

The object of the test is not to secure maximum yields, but to grow the corn under average conditions prevailing over this section. Soy beans were planted in the drill with the corn and this practice should be followed where corn is grown, regardless of the types of soils. While it may reduce the corn yield some, benefit to the soil more than offsets the value of the grain lost, and is noticeable in several subsequent crops.

In 1928, the highest yielding varieties were Hastings, 1st., Whatleys, 2nd., while the 1929 results show Mosby, Cockes, Smith's Improved (a local white prolific), Stewart's Yellow Dent, Whatley placed in order named. The prolific varieties in both cases are in the lead. While the Calhoun Red Cob is not one of the highest in production, it is a valuable and popular variety. The quality is good and the production is usually satisfactory and for general farm use, where the feed is not ground, it is more satisfactory for bulk feeding than the harder, flinty prolific varieties. Where a mill is available, for grinding the whole ear, the prolific varieties would be more popular.

SOY BEAN VARIETY TEST.

One-row plots, 120 feet long, with four replications are used in this investigation. One half of each plot is harvested, at the proper stage, for hay and the remainder matures and the bean yield secured.

Superphosphate, at the rate of 250 pounds per acre and Nitrate of Soda, at the rate of 50 pounds per acre, are applied in the drill prior to planting. Clean cultivation is given as the season demands.

Several Biloxi hybrid beans, besides more than half a dozen other varieties are tested, yielding from 10 bushels per acre to 21¾ bushels and with hay yields of from ¾ of a ton to 1¼ tons per acre. None of the later varieties matured seed during the 1929 season, on account of the dry weather during the blooming period.

STOCK AND PLAN OF PROJECT.

Ten grade Jersey cows have been purchased, being selected by R. H. Lush, Professor of Dairy Research, La. State University. Seven have one year's production records and were bought in Lincoln Parish. Three were purchased locally and on which no records were kept. All but three of the cows have calved recently, the others are to freshen soon.

A daily record of production and feed consumed is kept and the milk of each cow tested once a month for butter fat percentage. The heifer calves are kept and after being with their mothers about three days, are taken away and raised by hand, on whole milk the first three or four weeks and gradually shifted to powdered milk. About the same time they are taught to eat a ground grain mixture, to which, later, the dry milk powder is added, discontinuing the liquid diet entirely.

The bull calves are disposed of as soon after birth as the condition of the cow permits.

A study will be made of the value of a purebred bull mated to these cows, to determine the influence in increasing the production and improving the type of the cow. Too, it is planned to show the influence on production of a more liberal and balanced feeding system than is now being practiced here. The cows are to be fed on home grown feeds as nearly as possible.

BUILDINGS AND EQUIPMENT.

The main barn is composed of a feed room, milk room and milking room, the entire building measuring 18 feet by 45 feet, with nine foot walls. The mangers, floors and side walls, up to three feet high, are of concrete, and the remainder is built entirely of second hand lumber. The work of building it was done entirely with Station day labor, withou tthe aid of a carpenter. The milk room is equipped with a partly submerged cooling tank, to which an electrical refrigerating unit is attached. The milk can be cooled to a low temperature in a short time, making it possible to ship the morning milk at around 45 degrees. The whole milk is shipped and sold in bulk, in Monroe.

A shed, large enough to house all of the cows, is built south of the barn, in a separate lot, and is fitted with a trough and hay rack the full length of the building. The West, North and East sides are closed, leaving the South side open at all times. All of the roughage is fed in this shed, the milking barn having only the grain fed in it at milking time.

A calf shed and box stall is built between the barn and the highway, also in a separate lot, in which calves and cows with young calves are kept. It is also enclosed on all sides except on the south. Stanchions are placed in the shed, in which the calves are fed.

PASTURAGE.

In order to find the value of winter and summer pasture crops, in milk production, rye and oats, with other crops, as vetch winter peas, are planted in the fall and the grazing controlled during the winter. For summer grazing cultivated crops will be used, as well as permanent pastures. In the permanent pastures one half is limed, and with other treatments, the values of a permanent pasture and an all year round grazing will be demonstrated.

NEW EQUIPMENT.

During the past fall, the Director of Experiment Stations has furnished, for the use of this Station, a "Corsicana" Grading Machine, one small grain seeder, one soy bean harvester and a "Friend" power spray machine.

While the Station fields are fairly well terraced, a better system of terraces is badly needed and with the equipment formerly used for this purpose, building terraces over the whole property was a slow and expensive operation. With the "Corsicana" the use of a plow can be eliminated and in other ways, reduce the expenses of this operation considerably.

In sowing small seeds, such as clovers, the grain seeder can be used to advantage, while the soy bean harvester will reduce the expense of harvesting this crop to the point that the beans may be sold for seed at a profit.

The power spray machine is filling a long felt need. On account of not having adequate facilities for properly spraying the pecan and fruit trees, scale damage has practically killed some of the pecan trees and most of the peach trees. With this machine on hand, the proper spray schedule can be followed and all trees protected from pests at all times of the year.

With the assistance of Dr. Julian C. Miller, Head of the Horticultural Department, this work has already been started and all fruit and nut trees will be given sufficient attention to assure a fruit crop, from this stand point.

LIVE STOCK AND FARM EQUIPMENT.

The animals for the farm work of the Station consist of five mules and one mare, all of which are either home raised or raised in the community. Two young mules have been raised here in the past five years and the purpose in securing the mare was to continue raising mules. However, no jack is within reach, so the mare has not been bred. The mare is five years old, weighs about 1200 pounds and works well at all farm work. The other three mules are getting old and will have to be disposed of within the next few years.

The farming tools consist of heavy break plows, middle bursters, harrows and two one-row cultivators. For several years, a Fordson tractor, with a two-bottom break plow and a Roderick-Lean harrow, was used to advantage, especially in preparation of the soil for planting. The whole outfit has been worn out and discarded. With new equipment of this nature, the fall and winter breaking would be speeded up, and at considerably lower cost than is now being done with the mule power. An International "Farm-All", or a machine of that type, with the necessary plows, harrows and cultivators, would suit our needs admirably.

MARCH, 1930 LOUISIANA BULLETIN No. 205

REPORT OF THE RICE EXPERIMENT STATION FOR THE YEARS
1928-1929

BY

J. MITCHELL JENKINS

LOUISIANA STATE UNIVERSITY
AND
AGRICULTURAL AND MECHANICAL COLLEGE
AGRICULTURAL EXPERIMENT STATIONS

C. T. DOWELL, Dean and Director

FOREWORD

I have asked each of the Superintendents of the substations to write a narrative report of the work done at his station during the last two years. You will notice that no tables are given. The details in regard to the different experiments will be reported later in bulletin form, at the time of the completion of the project or at definite stages in the progress of the project.

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C. T. DOWELL,
Dean and Director.

REPORT OF THE RICE EXPERIMENT STATION FOR THE YEARS 1928—1929

WEATHER OBSERVATIONS

The uncertainty of the weather in southwestern Louisiana is indicated in comparing certain phases recorded for the years 1928 and 1929. In the first place, the year 1928 was one of the driest on record at the Station, with a total precipitation of only 43.21 inches; while the year 1929 with a total precipitation of 66.99 inches approached very closely the highest annual precipitation so far recorded at this Station. The 20-year average annual precipitation is 56.33 inches. It is also interesting to note that some years those months usually thought to be rather dry, became the record wet months of the year. For instance, take the months of May and November. In 1928 the total for May was 1.06 inches and for November 3.13 inches; while in 1929 these were by far the wettest months of the year with a total precipitation of 13.35 inches for May and 14.92 inches for November; the latter approaching within 2.12 inches the record precipitation recorded for any one month in the 20 years in which records have been kept. The 19-year average precipitation on record for these two months is 4.40 inches and 3.84 inches respectively.

Another interesting comparison is that of temperatures. While there is not very much variation in the extremes and means there is a decided range in the days with a temperature of freezing or below, and the dates on which they occur. In 1928 for instance freezing temperatures occurred on 19 days with none for March; while in 1929, freezing temperatures were recorded on 24 days, one of which was in March. The year 1929 had more freezing days than any other year since 1918.

THE EFFECT OF THE WEATHER ON THE RICE CROP

Both years the weather was favorable for plowing during the winter months. This was especially true in

1928, during the month of January. The spring work was delayed in March of 1929, but favorable weather in April enabled seeding operations to go forward to completion with few interruptions. In 1928 there was very little rain in May, making conditions rather unfavorable for germination of rice. In many instances it was necessary to flood the seedbed to cause germination. In 1929 very heavy rains occurred from May 14-18 inclusive, flooding many fields to a depth of 18 to 20 inches. Fields that had not long been sown, were injured by the weeds that emerged along with the rice, as a result of the constant rains. This condition resulted in greatly reduced yields in certain areas. This was especially true of some of the station plots.

Excellent harvest weather obtained both years. This was especially true in 1929, as late as the last few days of October, when heavy rains started and continued with rather short intervals to the end of the year. Seldom before in the history of this Section has such excellent harvest weather obtained as during the fall of 1929. This excellent weather however had a tendency to force down rice prices as practically the entire crop was ready for market at one time.

THE RICE MARKET

At no time during the fall months of both 1928 and 1929, was the price of rough rice entirely satisfactory to all concerned. The general situation was about the same as in previous years. From time to time effort has been put forth by one group after another toward making some provision for advertising rice, or in some other way strengthening the activities of the industry, but so far it seems that no method has been found that is satisfactory to a sufficient number of those interested in the crop. From all indications it seems that there must be more effort exercised toward increasing the output of popular table rices, and a closer cooperation of all persons interested in the growing and marketing of rice.

STATION RESULTS

All experiments that were conducted in 1928, were repeated in 1929, save certain fertilizer tests which were discontinued, after being conducted for a period of ten years.

These fertilizer experiments were conducted in duplicate, and on the same land each year. Each plot being inclosed by a levee and irrigated and drained independently, the fertilizers could not be conveyed from one plot to another. Every fifth plot was used as a check and received no fertilizer.

The fertilizers were used singly and in several combinations. Sulphate of Ammonia, Nitrate of Soda, Dried Blood, and Cotton Seed Meal, were used as sources of nitrogen. Sulphate of Potash as a source of Potassium and 16% Acid Phosphate as a source of Phosphoric acid. Lime was applied in the form of ground limestone. Stable manure was used also.

In all there were 15 different applications of fertilizer used in this set of experiments. Taking the ten-year average of the six check plots, and the ten-year average of the different fertilizer applications, only five produced more than the check, and the remaining ten produced less. In no case was the difference sufficient to meet the extra expense incident to the purchase and handling of the fertilizer. From this set of tests it is very evident that commercial fertilizers cannot be depended upon to increase rice yields when applied each year to the same land at the rates and to the kind of soil used in this experiment. The greatest increase was from an application of 200 pounds composed of equal parts of sulphate of potash and sulphate of ammonia. Slight increase in yield was noted from the following in the order given: Sulphate of Potash, Dried Blood, Stable Manure and Cotton Seed Meal. In every instance where acid phosphate was applied alone, or in combination the yield was below the check. Limestone alone did not increase the yield and in relatively large quantities was injurious as long as 8 years after the last application.

Another set of fertilizer experiments that has been under way for the past eight years including 1929, is to be discontinued to give way for other experiments including the same fertilizers as the set discussed above, save that Limestone and manure were not included. This experiment was not conducted in duplicate but in rotation with Biloxi soybeans. The bean seed was harvested, leaving the remaining portions of the plant which was plowed under.

In comparing the results for the eight years, it is noted that sulphate of ammonia with sulphate of Potash, 100 pounds each per acre, gave an increase, over the check plot of sufficient size to be profitable. Others gave an increase but not sufficiently large to be profitable. Acid Phosphate alone and in combination save when combined with the other two elements (nitrogen and Potash), reduced the yield. There was an increase also from some of the other fertilizers in the order named: Dried Blood, Cotton Seed Meal, and Sulphate of Potash.

All yields from this experiment were much larger than those secured in the fertilizer experiments in which rice was seeded on the same land each year. In fact the average yield from the check plots was higher by 368 pounds than the highest yield from the fertilizer plots seeded continuously to rice. This would indicate that one might expect much higher yields from rice when grown in rotation with soybeans than when grown with commercial fertilizers; also that the application of Sulphate of Ammonia and Sulphate of Potash will give profitable returns when applied to rice that is grown in rotation with soybeans.

Another set of fertilizer experiments conducted continuously on the same land over a period of ten years, using three sources of Phosphoric Acid; while not giving profitable results indicate that Raw Rock Phosphate is to be preferred to Acid Phosphate or Duplex Basic Phosphate. Acid Phosphate appeared injurious to plant growth after the plants were submerged and encouraged weed growth. Raw Rock Phosphate did not seem to do either of these things. Duplex Basic Phosphate at times appeared injurious.

In summing up the whole matter of fertilizers for rice, it would seem: 1st., that their advantage is somewhat doubtful, and that there is much more to learn regarding this subject, 2nd., with the information at hand it appears that if results are to be secured from commercial fertilizers they must be applied to rice that is grown in rotation with some crop, especially with soybeans; 3rd., that rice needs an abundance of nitrogen and potash, and very little phosphoric acid. Also that these can be best applied in the form of sulphate of ammonia, sulphate of potash, and Raw Rock Phosphate; the latter to be applied probably in rather large quantities with intervals of several years between applications.

RICE VARIETIES

The same studies pertaining to rice varieties have been continued from year to year. Usually new ones are added to the collection each season, and promising ones are increased. During the past two seasons special attention has been given to early maturing varieties, as there is great need for an early maturing rice of good table and milling qualities. Several promising ones have been increased and their table qualities are being determined. If a rice has not culinary properties that are attractive, it is unwise to place such a rice on the market, even if its behaviour in the field and in the mill is entirely satisfactory. This is being recognized more and more by the rice trade as indicated by inquiries and the readiness displayed each year by a larger number of persons in the different phases of the rice industry to test new rices, with a view to finding merits lacking in the present commercial varieties.

CULTURAL EXPERIMENTS

Beginning with 1928, several new cultural experiments were begun, and some of the older ones continued. There has scarcely been time to accumulate sufficient data on the new ones, upon which to base conclusions.

These include rice grown in rotations as follows: With different soybean varieties; with soybeans cut for hay and soybeans harvested for seed; with soybeans grown in close drills and not cultivated; with soybeans cultivated in wide rows; with soybeans grown two years; with summer fallow one year and summer fallow two years; with pasture one year and pasture two years; and various other rotations. Some including cotton and soybeans in a three-year rotation; others including rice in rotation with fertilized cotton and rice in rotation with unfertilized cotton.

In comparing the yields of some of the rotations that have been underway for several years it was found that the average yield for the past two years following soybeans was 500 pounds more than the average yield following pasture. The same difference was found in the average yield over the entire 9-year period. In addition to the increased yield of rice there was an average yield of 8 bushels of soybean seed per acre. No soybeans were harvested in 1929, due to damage from the velvet bean caterpillar.

In the rotations including cotton, the highest average yield of rice for the ten years was from those plots in which soybeans were included in a 3-year rotation and the lowest from the plots conducted in rotation with fertilized cotton. The best yield of cotton was obtained from the plots that were fertilized. The fertilizer that remained in the soil seemed to have a bad effect on the rice following; due it appears to the large quantity of superphosphate used on the cotton, as this fertilizer in liberal quantities in all the fertilizer experiments had a tendency to reduce rather than increase yields.

In comparing the yields of rice following soybeans harvested for hay, harvested for seed, and grown in close drills and turned under after maturity; we have only two years' results. This is true of other rotations discussed below. It is however noted that the average is decidedly higher when only the seed was harvested, and much lower when rice followed uncultivated soybeans, grown in close drills, and turned under after maturity.

In growing rice in rotation with Biloxi, Otootan and Barchet soybeans cultivated in 4½-foot rows, the 2-year average yield of rice was much greater following Barchet beans than when it followed the other two varieties. The lowest yield was from the plots grown in rotation with Biloxi beans. This land before beginning this rotation had been devoted continuously to rice for the past eight years. When grown on such land Biloxi beans make a rather poor growth. This might account in part for the difference of 580 pounds per acre less in the 2-year average yield of rice, following these beans, than where rice followed Barchet beans.

DISKING VS. PLOWING IN PREPARATION FOR SEEDING RICE FOLLOWING SOYBEANS

For the past four years an experiment has been conducted to determine whether or not there is any necessity for plowing land in preparation for seeding rice which is to follow a crop of cultivated soybeans. The results so far indicate that plowing is unnecessary. In two out of the four years land that was only disked produced more rice than that that was plowed as well, and the four-year average yields show practically no difference. Grass and other weeds are also more easily controlled by not plowing, especially if the beans have been thoroughly cultivated.

SEEDING RICE ON DIFFERENT DATES IN WATER OF DIFFERENT DEPTHS

From a study of two years, results in seeding rice in water it is noted that a better stand resulted when seeded at a depth of 4 inches than when seeded at depths of 2 or 6 inches; however, the difference is not very great. A better average germination was secured from seedings made the middle of March than from those made the middle of April and the middle of May. Four varieties of rice were used. The highest germination was secured from Blue Rose and from the other varieties in the order given: Early Prolific, Fortuna and Honduras.

In all cases the germination was rather low, indicating that in using this method the rate of seeding should be high.

RESTRICTED SEED DISTRIBUTION

It has been the custom of this station to distribute to rice farmers in the State of Louisiana, seed rice of promising new varieties. This has been for the purpose of increasing the seed, and at the same time obtaining information relative to the behavior of these rices under general farm conditions. This is very necessary in that the station is not large enough to have land available for this purpose.

Farmers take such seed, in quantities sufficient to plant one or two acres, agree to dispose of all seed produced in accordance with some plan approved by the station. The main requirement is that all seed produced shall be used for planting, after a portion that might be required is used for milling tests.

The outcome of one such arrangement is the commercial acreage devoted to the Fortuna variety. Some have estimated that as much as 30,000 acres were grown to this rice in 1929, an increase of about 10,000 acres over 1928. The greater portion of this acreage was in the state of Louisiana. Fortuna usually produces much heavier yields than other commercial rices. On the station over a long period of years, the average yield has been about 3 barrels more than that secured from one of the commercial varieties that is most extensively grown.

Another variety introduced in this manner two years ago, known as Rexoro, is receiving considerable attention, because of its yielding ability, and its ability to withstand dry conditions, if required to at time of heading and maturity. Another very attractive feature is its excellent table qualities. Its close resemblance to certain imported varieties gives promise that it will eliminate the necessity of importing such rices.

Delitus rice was distributed several years ago, and gained considerable popularity with those desiring a specially flavored rice. Due to lack of interest on the part of growers and millers the acreage devoted to this variety has been very small. Recently the trade has been asking for it and if given the attention it deserves it will no doubt become one of the most popular rices; for it is an excellent table rice, having a distinct flavor, and excellent cooking qualities. The field yield is not extreme, but of a high average.

COOPERATIVE COTTON EXPERIMENTS

These results will appear in another publication.

ENTOMOLOGICAL INVESTIGATIONS

The representative of the Bureau of Entomology of the United States Department of Agriculture continued his investigations pertaining to Rice and Soybean insects. Under date of December 1929, he published the following relative to the velvet bean caterpillar, an insect attacking soybeans for the first time in southwestern Louisiana:

"The soybean is a valuable legume on the rice plantation. A blister beetle, or Spanish fly, is ordinarily the only serious pest of the crop in Louisiana, but in 1929 considerable damage was done by an insect known as the velvet bean caterpillar.

"The adult of this pest is a moth which is not definitely known to pass the winter in the United States. It is supposed to fly north in the summer from Cuba or possibly from southern Florida. It deposits eggs on the leaves of bean plants. These eggs hatch into small larvae, or caterpillars, which soon begin to feed on the most tender leaves, but as they increase in number they attack all parts of the plant, even the stems themselves and the bean pods.

"The caterpillar is a black, or dark green striped larva, reaching a length of one and one half inches. It jumps violently off the plant when disturbed. When holes are noticed in the top leaves of the soybean plants the presence of the caterpillars can be suspected. These caterpillars, when few in number, are difficult to see against the green leaves, but when the plant is shaken they suddenly fling themselves to the ground.

"On becoming full grown, the caterpillars burrow in to the ground, forming earthen cells from one-fourth of an inch to an inch and a half below the surface. In these cells they pass the pupa, or cocoon, stage. In the course of a week or less in summer a new generation of moths will emerge from these pupae. It is the second generation of this insect which was found to do the greatest damage.

"It will immediately occur to the rice planter that flooding the fields might kill these pupae, but flooding has been tried and has proved unsatisfactory. A shallow cultivation will destroy many pupae. They are usually close to the bean plants, and cultivation therefore should be carried as near the plants as possible.

"Several insecticides have been tried, including calcium arsenate mixed with hydrated lime. While calcium arsenate and lead arsenate kill the caterpillars, they also kill the soybean plants, and their use therefore cannot be recommended.

"Sodium fluosilicate dust, however, has been found to be entirely satisfactory. This is the same chemical which rice planters are already using against the blister beetle. The light grade of dust is to be recommended as it is more economical, being cheaper and spreading better. The dust should be applied on dry plants at the rate of from ten to twelve pounds per acre. A heavier application may slightly injure the plants, and moisture on the plants may cause burning. For fields of less than one hundred acres hand dusters may be used unless a cart duster is readily available. The plants should be dusted as soon as any sign of injury is noticed. Sometimes a second application may be necessary if a new generation appears or in case caterpillars should march in from a neighboring field.

"Several fields of soybeans in southern Louisiana and Texas were saved during 1929 by the timely application of sodium fluosilicate.

"The caterpillar may not appear during the coming year, but since the blister beetle is an annual visitor it would be advisable to have at least a small supply of sodium fluosilicate on hand."

MARCH, 1930. LOUISIANA BULLETIN No. 206

REPORT OF THE FRUIT AND TRUCK EXPERIMENT STATION FOR THE YEARS 1928-1929

BY

B. SZYMONIAK

LOUISIANA STATE UNIVERSITY
AND
AGRICULTURAL AND MECHANICAL COLLEGE
AGRICULTURAL EXPERIMENT STATIONS

C. T. DOWELL, Dean and Director

Foreword

I have asked each of the Superintendents of the sub-stations to write a narrative report of the work done at his station during the last two years. You will notice that no tables are given. The details in regard to the different experiments will be reported later in bulletin form, at the time of the completion of the project or at definite stages in the progress of the project.

I think the farmers are more interested in the purpose of the project and the results obtained than they are in the details. It is for that reason that I have had the reports written in this form.

C. T. Dowell, Dean and Director

REPORT OF FRUIT AND TRUCK EXPERIMENT STATION

HAMMOND, LA.

Herewith is presented a general report on experimental work done at the Fruit and Truck Experiment Station, summarizing Fertilizer tests for Strawberries from 1922 to 1929, and other projects.

For a period of five years Super-phosphate, Nitrate of Soda and Muriate of Potash were applied alone and in combination with each of the other ingredients in variable proportions to determine the best combinations. All three elements were found to be necessary for best yields and quality of strawberries. The highest yields were obtained where an increased amount of Super-phosphate was used—in combination with Nitrogen and Potash. Fertilizer ratio of 1N-3P-1K, indicated most favorable results,—on our type of soil, and made up of 250 pounds of Super-phosphate, 90 pounds of Nitrate of Soda 14.8%, or 60 pounds of Sulphate of Ammonia 22% N and 27 pounds of Muriate of Potash 50% K_2O, applied at the rate of 1500 pounds per acre.

Comparing the different sources of phosphate, nitrate and potash elements in the fertilizer mixtures—the following results were obtained—Super-phosphate gave better results than bonemeal or dicalcium phosphate. In a comparative test of Nitrate of Soda—Sulphate of Ammonia, Nitrate of Lime Calurea, Cotton seed meal as sources of nitrogen element—we obtained best results from Calurea, Nitrate of Lime, Sulphate of Ammonia and Nitrate of Soda in the order mentioned. There is no difference in yields from the use of Sulphate of Potash as compared with Muriate of Potash.

The rate of application of the following mixture of fertilizer was:

Super-phosphate	16%	1500 pounds
Sulphate of Ammonia	20%	400 pounds
Muriate of Potash	50%	160 pounds

The best yield was obtained where 1500 pounds of the fertilizer mixture per acre was applied. The yields were reduced where 4,000 pounds of the above fertilizer mixture were applied.

General recommendation for commercial fertilizer application can be given on the basis of experiments conducted in the seven years 1922-1929 as follows:

A complete fertilizer 1N-3P-1K ratio should be applied when runner plants are forming or during plant propagation during the summer. Another application of fertilizer at the rate of 1500 pounds should be given at time of setting out strawberry plants in the Fall. Top dressing with Sulphate of Ammonia or Nitrate of Soda at the rate of 75 to 100 pounds per acre—when plants are mulched with pine straw about the first week in February—has given us the best results.

In testing varieties of Strawberries we have not found any that have proven satisfactory. Further trials are being carried on with crosses originated by the U. S. Department of Agriculture and Louisiana Experiment Station.

Results of one season with the use of mulch paper for Strawberry culture were unsatisfactory. The paper decayed during the winter allowing the weeds to grow among the strawberry plants. At first the mulch paper had a stimulating effect on the strawberry plants—but the heavy rains during the winter months caused the paper to decay. Further tests are being made with heavier mulch paper.

Soil treatments: Treatment of the soil was given in the form of top dressing just after "scraping" the soil around the plants. The following ingredients were used: Uspulun, Flowers of Sulphur 600 pounds per acre, Oxidized Sulphur, Hydrated Lime 3,000 pounds per acre, Copper Sulphate 45 pounds per acre, Calcium Sulphate 1,000 pounds per acre. The hydrated lime application, one season's results, shows beneficial results, causing more vigorous growth of plants and increased yield of fruit. Calcium Sulphate gave detrimental results—low yields and reduced vigor of plants.

MUSCADINE GRAPE CULTURE

The work with Muscadine grape culture was done along the lines of methods of training and pruning and variety tests. Of all varieties tested for quality of fruit, yield and vigor of plants the Thomas variety has proven the best. Vines were planted 10 feet apart and interplanted with male vines, in the ratio of one male vine to 10 female vines.

The Thomas variety is well adapted to the lighter types of sandy loam soils and for best results should be trained to two wires, first wire three feet from the ground, the second wire 3½ feet above the lower wire. The fruiting arms are allowed to form along these wires and are best pruned to spurs 3 or 4 buds each. The three wire system may be used to give the vines more fruiting area on heavier and more fertile types of soil, in which case six main branches will carry the fruiting spurs instead of four as in the two wire system. Pruning develops larger fruit and more uniform ripening which begins with the Thomas variety about the 20th of August. Fertilizing with 200 to 600 pounds of Super-phosphate and 100 to 200 pounds of Sulphate of Ammonia or Nitrate of Soda is recommended for Spring application. A cover crop of Soy beans or Cowpeas is planted the latter part of March or first week of April and this disced under the first week in August. The Thomas variety of Muscadines is high in sugar content—well adapted to making unfermented grape juice, preserves, marmalades and other products.

BLACKBERRY AND DEWBERRY CULTURE

A soil of the clay loam type that retains moisture was selected for blackberry culture. The MacDonald blackberry was interplanted with Lucretia dewberry for pollination, three rows MacDonald to one row Lucretia. The plants were set three feet apart in rows five feet apart. The plants came into bearing the second season after setting out and bore at the rate of 50 crates of fruit per acre. The fruit was medium in size, elongated, firm, of excellent quality and adapted to shipping. MacDonald's shipped to Chicago and Detroit arrived at these markets in excellent condition —it was reported,—when shipped with strawberries in refrigerated cars. In later seasons the MacDonalds increased in yield to 150 crates of 24 pints per acre. After five years of test we find it necessary to replant the vines to a new field to prevent crowding of fruiting plants and enabling the better to control the insects and diseases on the new reset plants. January or February is the best time for planting. The land should be prepared in advance and it is best to have it in cultivation the previous season before setting the young plants. After flat breaking—the soil should be put up in ridges five feet apart—for drainage—the first season—the plants may be fertilized with a complete fertilizer. When barn yard manure is not available, at the rate of 500 to 1,000 pounds of 4%

Nitrogen, 8% Phosphorus, 4% Potash and interplanted with a tillable crop such as Soybeans, these plowed under for humus in October. Later as the plants become larger—clean cultivation is given in the Spring and Summer immediately after harvest which begins about the 20th of May and extends to the latter part of June. It is very well adapted as a crop to follow strawberries in this section.

SATSUMA ORANGE CULTURE

The Owari variety trees one year old were set out in February, 1926, and spaced 20 by 20 feet apart on sandy loam well drained soil.

Fertilizer test applying:

10 pounds Nitrate of Soda	to 10 trees.	Row No. 1.
10 pounds Nitrate of Soda 40 pounds Super-phosphate	to 10 trees.	Row No. 2.
10 pounds Nitrate of Soda 40 pounds Super-phosphate 5 pounds Muriate of Potash	to 10 trees.	Row No. 3.
10 pounds Nitrate of Soda 40 pounds Super-phosphate 10 pounds Muriate of Potash	to 10 trees.	Row No. 4

Row No. 4 seems to be more vigorous and trees made best growth.

Row No. 1 produced late terminal growth which was injured during winter freezes. Fertilizer applied in April—cover crop of Cowpeas planted for Summer and plowed under in September for humus.

PECAN CULTURE

Two main projects are followed in Pecan Culture. Variety tests and stocks for pecans. Trees have been planted on different types of soil and spaced 60 feet apart. While the trees were young, crops of soybeans and corn were cultivated and fertilized between the trees, with fertilizer consisting of 4% Nitrogen, 8% Phosphorus, 4% Potash, at the rate of 200 pounds per acre and a top dressing of Nitrate of Soda given the corn and soybeans when about a foot high. The pecan trees are 8 years old and made satisfactory growth on upland. The low lands where hard pan is found have not proven satisfactory for pecans. The trees have not yet come into bearing to give results of either varieties or the influence of different stocks on same variety. Hicoria Acquatica made the most vigorous growth as a nursery tree for budding and grafting.

A test of different species of plants including such as: Blueberries, Mayhaws, Jap. Persimmons, Tung oil trees, Kumquats, Pears, Apples, Quince, Plums and Nectarines is being made—

The blueberries which are adapted to an acid soil have some promise of being adaptable to our section when a desirable variety is selected. Thus far no variety has been found that can be recommended.

There is some interest in the culture of Mayhaws. Plants were picked out of the native habitat and are being cultivated. Trees have not yet come into bearing after four years of growth.

The Triumph and Tane Nashi Persimmons came into bearing the fourth year after setting out and are prolific, being well adapted to our soil conditions.

The Tung oil trees bore some fruit the third year after planting —the fifth year producing 5 pounds of dried fruit per tree. The trees withstood temperatures of 15° F. without injury and are adapted to upland clay loam soils in this section of Louisiana.

The Chinese sand pear, Kieffer, Garber and LeCompte have resisted fire blight when grown without cultivation. The Pineapple pear being most resistant but not of as good quality as LeCompte.

The Apple trees grown here have not proven satisfactory—being shy bearers, subject to fire blight and blister canker—the Mammoth Blacktwig and Winesap are most resistant to diseases but do not set much fruit.

The Mammoth Quince has not set fruit after fifth year of growth.

The Japanese varieties of plums are subject to brown rot and blight or die back of the twigs—The variety giving best results is the Excelsior. The Nectarines have not produced fruit—the blooms having been killed by spring frosts.

FEBRUARY, 1930. LOUISIANA BULLETIN No. 207

BATON ROUGE, LOUISIANA

COTTON VARIETIES FOR LOUISIANA

A Preliminary Report.

By H. B. BROWN

Cotton Variety Station No. 2
Twenty six Varieties and Strains
in five series. Planted April 10.

LOUISIANA STATE UNIVERSITY
AND
AGRICULTURAL AND MECHANICAL COLLEGE
AGRICULTURAL EXPERIMENT STATIONS

C. T. DOWELL
DEAN AND DIRECTOR

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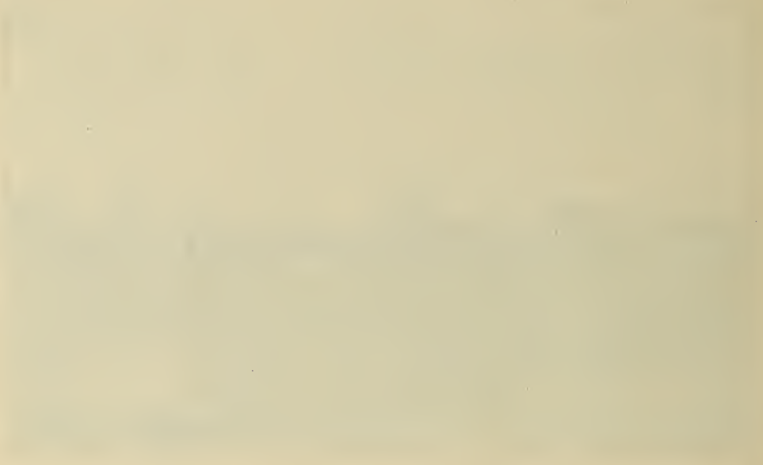

COTTON VARIETIES FOR LOUISIANA

PRELIMINARY REPORT*

By H. B. Brown

In 1928 the cotton crop of the United States amounted to 14,478,000 bales, and on December 1, 1929, the 1929 crop was estimated at 14,919,000 bales. The actual production for 1929 will doubtless be very near that figure.

According to data collected by the Bureau of Agricultural Economics, U. S. Department of Agriculture, bales of the 1929 crop, ginned prior to November 1, had a staple length as follows:

Staple length in inches	Bales	Per cent
13/16 and under	2,220,800	20.4
7/8	4,063,700	37.3
15/16	2,092,700	19.2
1 and 1 1/32	1,261,400	11.6
1 1/16 and 1 3/32	663,600	6.1
1 1/8 and 1 5/32	465,500	4.3
1 3/16 and 1 7/32	107,900	1.0
1 1/4 and over	6,800	0.006

Data on the grade of the bales of the 1929 crop, ginned prior to November 1 ran as follows:

Grades ‡	Bales	Per cent
White, middling and better	8,204,900	75.4
White, strict low and low middling	1,451,000	13.3
White, below low middling	39,500	0.4
Spotted and Yellow Tinged	969,500	8.9
Light Yellow Stained, Yellow Stained, Gray, and Blue Stained	4,200	†

The figures presented by the Bureau of Agricultural Economics in the tables and in other reports are based on a study of samples from all the bales ginned by a large number of representative gins located over the entire Cotton Belt. This is probably the most accurate data ever collected on the grade and staple length of the American cotton crop.

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* This preliminary report is issued on account of the demand from growers and county agents for data on cotton varieties in Louisiana. The Experiment Station has not issued a bulletin on cotton varieties for several years.

‡ A much higher percentage of low grade cotton will be found in the bales ginned after November 1.

† Less than 0.1%.

TABLE I
COTTON PRODUCTION BY STATES

State	Acreage For 1929 Crop		Yield Per Acre Left For Harvest			Production (Ginnings) 500 lbs. gross wt. bales (a)		
	Left for Harvest	In Culti-vation July 1	10-yr. average 1918-1927	1928	1929 (Dec. 1 est.)	1927 crop (b)	1928 crop (b)	1929 crop Dec. 1 est. (b)
	Thous. Acres	Thous. Acres	Lbs.	Lbs.	Lbs.	Thous. bales	Thous. bales	Thous. bales
Virginia	88	89	246	265	250	31	44	46
N. C.	1,782	1,818	260	215	197	861	836	735
S. C.	2,183	2,228	185	147	185	730	726	845
Georgia	3,782	3,847	140	132	170	1,100	1,030	1,345
Florida	95	97	105	97	145	17	19	29
Missouri	343	350	249	210	300	115	147	215
Tennessee	1,120	1,137	181	185	220	359	428	515
Alabama	3,589	3,633	145	150	178	1,191	1,109	1,335
Mississippi	4,071	4,133	177	175	225	1,355	1,475	1,915
Louisiana	2,050	2,079	152	166	189	548	691	810
Texas	17,872	18,912	133	138	106	4,352	5,106	3,950
Oklahoma	4,492	4,655	148	136	128	1,037	1,205	1,200
Arkansas	3,834	3,900	166	162	186	1,000	1,246	1,490
N. Mexico	130	132	(c)276	360	309	70	88	84
Arizona	226	227	283	357	330	(d) 91	(d)149	(d)156
California	309	317	282	378	375	91	172	242
Other	15	15	(c)194	152	223	7	7	7
U. S. TOTAL	45,981	47,569	155.8	152.9	155.3	12,955	14,478	14,919
Lower Cal. (e)	147	151	....	239	260	45	80	80

(a) Not including production of linters which is usually about 6% as much as the lint. (b) Allowances made for cross State ginnings. (c) Less than a 10-year average. (d) Including 25,000 bales Egyptian in 1927, 30,000 bales in 1928 and 34,000 bales in 1929. (e) Data for Lower California (Old) Mexico are NOT included in California figures NOR in United States total.

TABLE II

COTTON PRODUCTION IN LOUISIANA BY PARISHES

Number of Ginneries in 1928 and Quantity of Cotton, Exclusive of Linters, Ginned from the Crops of 1926 to 1928, by Parishes.

County or Parish	Ginneries		Total Quantity Ginned Number of equivalent 500 pound bales			Number of Bales Ginned to Dec. 13 (Counting Round as Half Bales)		
	Active	Idle	1928	1927	1926	1928	1927	1926
The State	745	132	690,958	548,026	829,407	675,262	535,674	772,013
Acadia	9	1	15,964	10,457	11,822	15,841	10,559	11,856
Allen	4	..	1,769	1,719	2,706	1,837	1,779	1,226
Ascension	3	..	585	595	1,007	601	632	1,030
Avoyelles	30	5	18,296	13,061	27,705	17,673	12,850	27,967
Beauregard	3	..	3,358	1,665	2,611	3,263	1,661	2,551
Bienville	19	12	23,037	19,292	35,094	23,000	19,367	34,454
Bossier	30	5	26,870	15,889	25,896	25,426	15,472	22,312
Caddo	40	4	66,637	44,915	61,800	62,813	44,099	54,119
Calcasieu	8	..	5,349	2,761	5,001	5,286	2,797	4,962
Caldwell	7	..	4,791	1,928	6,300	4,713	1,830	4,088
Cameron	4	..	1,913	2,028	2,429	1,843	2,033	938
Catahoula	14	3	9,012	4,880	13,917	9,054	4,392	12,601
Claiborne	23	1	27,585	30,718	38,446	26,987	29,195	36,774
Concordia	19	10	6,694	2,356	13,033	6,520	1,517	10,986
DeSoto	26	2	28,116	19,232	33,085	27,589	19,172	31,869
E. Baton Rouge	5	1	4,042	3,872	4,653	3,994	3,996	4,862
E. Carroll	17	..	21,158	13,580	20,140	19,097	12,438	14,901
E. Feliciana	8	2	4,433	6,521	8,765	4,454	6,354	8,641
Evangeline	17	..	15,257	18,220	15,928	15,422	18,357	16,301
Franklin	25	4	35,974	28,175	41,720	34,796	26,630	38,667
Grant	9	4	7,394	5,909	9,038	7,579	5,866	9,063
Iberia	4	1	1,874	1,778	1,755	1,810	1,711	1,723
Jackson	10	..	8,234	9,269	13,388	8,340	9,201	12,985
Jefferson Davis	7	..	5,826	4,380	6,614	5,852	4,401	6,607
Lafayette	15	1	19,191	15,747	16,493	18,856	15,729	16,531
LaSalle	3	2	828	(1)	711	798	(1)	607
Lincoln	18	3	24,414	22,256	31,998	24,542	21,994	30,485
Madison	15	8	11,402	2,812	15,449	10,847	2,441	12,614
Morehouse	15	5	19,984	17,267	21,000	20,032	16,398	18,229
Natchitoches	36	7	28,635	24,366	31,784	28,073	24,047	31,169
Ouachita	13	4	13,052	10,497	17,123	13,094	10,168	15,816
Pointe Coupee	14	5	5,746	4,635	11,701	5,795	4,616	11,492
Rapides	23	3	14,966	20,962	25,387	14,797	20,712	24,673
Red River	17	..	21,641	12,585	22,733	20,820	12,451	21,086
Richland	30	7	34,443	22,379	33,034	33,304	21,624	30,696
Sabine	14	2	11,375	10,096	18,027	11,280	9,944	17,468
St. Helena	3	2	1,101	1,341	2,501	1,159	1,359	2,388
St. Landry	35	5	32,045	29,132	42,329	31,774	28,666	42,336
St. Martin	5	..	4,068	(1)	5,319	3,956	(1)	5,396
St. Tammany	3	1	225	261	1,041	251	283	1,082
Tangipahoa	8	..	2,226	3,165	4,848	2,264	3,191	4,675
Tensas	27	13	15,447	8,425	20,310	14,801	7,729	14,686
Union	20	2	16,199	17,999	23,165	16,025	17,870	21,987
Vermilion	8	..	11,055	7,391	7,992	11,335	7,136	8,061
Vernon	9	1	3,172	2,651	4,104	3,199	2,546	3,963
Washington	22	3	6,784	8,759	12,367	7,196	9,236	12,375
Webster	17	1	21,096	17,952	26,416	20,203	17,385	24,598
W. Carroll	11	..	19,375	13,875	15,885	18,925	13,674	15,076
W. Feliciana	5	..	1,670	2,546	3,147	1,771	2,647	3,193
Winn	10	1	4,823	5,686	9,981	4,807	5,698	8,856
All Other	8	1	1,827	2,041	1,709	1,568	1,821	992

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(1) Included in "All other counties" to avoid disclosure of individual operations.

The cotton crop in Louisiana in 1929 was estimated on December 1 at 810,000 bales, a yield of 189 pounds of lint per acre. This was the best crop since 1926, and exceeded the ten year average by 235,000 bales.

The grading and stapling of the Louisiana crop is not reported separately from the national crop but the figures, if available, would probably be much the same as given in the tables on page 1. In the delta region of the northeastern part of the State, and on alluvial lands along the Mississippi River throughout the State, long staple cotton is grown principally. In the Red River valley and over most of the hill lands of the State short stable cotton is grown nearly altogether.

According to estimates made by the county agents there was growing in 47 parishes‡ in Louisiana in 1926 an acreage of different varieties as shown below:

Variety	Acreage	Per cent of crop
Half and Half	628,038	39.2
Cleveland	368,588	23.0
Mixed varieties	254,468	15.8
Delfos	221,772	13.2
D. & P. L. No. 4	22,896	1.4
Mebane Triumph	19,675	1.2
Toole	17,500	1.1
Salsbury	15,950	0.9
Brown No. 1	15,000	0.9
Rowden	7,875	*
Boykin	6,105	*
Money Maker	5,736	*
Acala	4,500	*
Cook	4,000	*
Rucker	3,798	*
Bank Account	2,000	*
Little Brandon	2,000	*
King	1,000	*
D. & P. L. No. 5	800	*
Lone Star	300	*
Dixie-Triumph	100	*

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‡ In most cases the parishes not reported produce little or no cotton.

* Less than one-half of one per cent.

Since 1926 there have been some changes in acreage of the different varieties. A lower acreage of mixed varieties is planted now and more of Wilson Cleveland, Delfos, D. & P. L. No. 4, and Dixie-Triumph. D. & P. L. No. 5 is not grown at present, but there is a considerable acreage of D. & P. L. No. 6 and No. 4 - 8. The present indications are that the acreage planted to Half and Half in 1930 will be much reduced.

A COTTON VARIETY

To be worthy of a variety name a cotton should be of a distinct type; that is, have some definite characteristics which mark it as being different from all other named varieties. At present there are so called varieties grown commercially that do not merit names; they do not represent different kinds of cotton. Losses may come to growers on account of this because it frequently happens that a change of variety is made at considerable expense simply because there was a new variety name put out and the variety highly advertised. A movement is on foot at present to provide for the official registration of all true cotton varieties of merit. This is to be Nation wide in scope and should be of some aid in fostering the sale of good varieties.

IMPORTANCE OF THE VARIETY PLANTED

Probably a good many cotton growers do not realize the importance of the variety planted, or its adaptation to their land. Under our present economic conditions, if cotton is grown profitably, a high yield must be produced, but a good yield will not be made unless a well adapted variety is planted.

Different varieties differ greatly in their adaptations. Some varieties do well in one locality and poorly in another just a few miles away. In fact, the adaptation may be narrowed even more—a variety may do well in one field and poorly in an adjoining one.

The difference in value and adaptation of various cotton varieties comes out in a striking way in variety tests that are conducted by the various experiment stations in the South. In these tests some twenty or more varieties are planted on one small piece of land. Here the land is practically the same for all the varieties; they are all planted the same day, given like fertilization and culture. An effort is being made to make conditions the same for all so that any difference in yield will be due to inherent differences in the variety itself. It is rather surprising what differences do appear where a number of varieties are grown under nearly identical conditions. In the Bluff Land variety test at Baton Rouge in 1929, the most productive variety produced lint and seed that were worth $106.59 per acre. Another variety in adjoining rows throughout the test had a total value of $53.19. The two had an equal chance but one made twice as much cotton as the other. One was not suited to the land, or in other words, was not adapted to it, while the other was well adapted. In the Alluvial Land test at Baton Rouge the past season the products of the best variety were worth $116.11, while the products of the poorest variety were worth $80.26. In another test which was conducted in the Red River valley near Shreveport, the total value of the best variety was $89.22, and the poorest $35.13. Figures similar to the ones just given may be found in the results of almost any variety test. Many illustrations could be given. It costs no more to grow a good variety than a poor one, yet the better one may give twice the monetary returns. It frequently happens that farmers grow, year after year, a variety not very well adapted to their land and do not know that it is not a first class variety. Unless two or more varieties are grown together in the same field and under nearly identical conditions it is difficult to judge comparative merits.

There seems to be considerable difference in the adaptation of varieties to conditions prevailing in different states. In Texas, for instance, a cotton of the Mebane Triumph type is most commonly recommended; in Arkansas new strains of Rowden developed by the Arkansas Experiment Station usually make the best showing; in Tennessee Trice was long a favorite and probably is still one of the best varieties grown in the State; in the Mississippi Delta in Mississippi, no variety is as popular as Delfos; in Alabama some strain of Cook is recommended most commonly. Cook has ranked high in tests there for a number of years. In Georgia, College No. 1 has been highly prized but in no other state has it made an exceptionally good showing. In South Carolina, Cleveland is probably the most popular variety. It, however, has made a good showing in several states. In North Carolina, Mexican - 6 is a favorite variety but it is not grown extensively elsewhere. Nearly every variety in the list given is most popular in the state where it originated.

LOUISIANA COTTON VARIETY STUDIES[*]

The Louisiana Experiment Stations have been conducting cotton variety tests for a good many years, but aside from brief sketches in annual reports nothing bearing on this subject has been published recently. This brief report covers in particular experimental data gathered by the writer and his co-workers since 1926.

In 1927 variety test work was started in several different sections of the State to learn something of the adaptation of various varieties and strains to different soil types and prevailing conditions. An effort was made to have these tests conducted in such a way that reliable data would be obtained. Seed of the various varieties was secured from the originators in most cases, planted in small plats with several replications, thinned uniformly, and much care used in carrying on the work at all stages of the experiment.

The following tables give much data on the comparative production of the various varieties and strains used in the tests, when grown under conditions prevailing in various parts of the State, and also important data on lint percentage, staple length, boll size, etc. The notes following the tables are intended to describe the conditions under which particular tests were made and point out the main conclusions to be drawn.

TABLE III

COTTON VARIETY TEST

Bluff Land, Baton Rouge, 1929.

Variety	Seed Cotton per Acre	% Lint	Lint per Acre	Length of Staple	Value of Staple per lb.	Value of Seed & Lint	Rank in Value 1929	3 Year Av. in Rank
1. Wann. Cleveland....	1098.7	36.6	402.1	7–8	17.17	79.49	15	14.3
2. Marett's Cleveland-7	933.0	36.0	335.9	15–16	17.47	67.64	19	....
3. Wilson Cleveland...	1190.3	34.0	404.7	7–8	17.17	81.27	14	9
4. Cleveland-54.......	1188.1	34.5	409.9	29–32	17.32	82.67	13	....
5. Half & Half........	660.5	43.2	285.3	13–16	16.67	53.19	21	21.0
6. Dixie Triumph......	1534.7	34.1	523.3	15–16	17.47	106.59	1	3.6
7. Mebane Triumph...	928.7	37.7	350.1	1	18.17	72.29	18	18.6
8. Rowden-40.........	1386.5	33.1	458.9	1	18.17	97.30	4	*5.5
9. Acala-37...........	1148.9	35.9	412.5	1	18.17	86.00	10	†11.6
10. D. & P. L. No. 4....	1238.2	34.6	428.4	1	18.17	89.99	7	8.
11. D. & P. L. No. 4–8..	1201.2	38.4	461.3	1	18.17	94.92	5	5.
12. Stoneville No. 2.....	1225.2	33.7	412.9	1 1-16	18.92	90.30	6	3.3
13. Delfos-911..........	1181.6	31.6	373.4	1 5-32	20.04	86.95	8	14.6
14. Delfos-6102-A2C3...	1161.9	31.9	370.6	1 1-8	19.42	83.84	11	13.6
15. Missdel No. 2.......	1081.3	33.5	362.2	1 5-32	20.04	83.37	12	13.3
16. Missdel No. 1.......	946.1	33.3	315.1	1 5-32	20.04	72.61	17	*15.5
17. Delfos No. 2........	1199.0	31.8	381.3	1 1-8	19.42	86.31	9	6.0
18. Express-317........	1369.0	33.5	458.6	1 5-32	20.04	105.56	2	2.6
19. D. & P. L. No. 6....	1288.4	33.5	431.6	1 3-16	20.67	102.06	3	3.0
20. Wilds No. 2........	939.6	31.0	291.3	1 7-32	21.67	72.85	16	*19.5
21. Deltatype No. 8....	717.2	31.3	224.5	1 7-32	21.67	56.04	20	13.3

* Two year average. † A different strain of Acala was used in 1927 and 1928.

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[*] John P. Gray and S. P. Landry assisted with the cotton work in 1929. Credit is due them and the growers with whom co-operative tests were conducted.

TABLE IV

COTTON VARIETY TEST

Bluff Land, Baton Rouge, 1929

Variety	No. of Stalks in 4 Plats	No. of Bolls per Pound	Comparative Rate of Blooming	% Rotten Bolls	% Wilty Stalks	Size of Plant	Foliage
Wann. Cleveland	595	78.0	911	7.2	0.5	Medium	Heavy
Marett's Cleveland-7	615	82.4	1104	11.3	2.2	Medium	Heavy
Wilson Cleveland	699	75.1	1081	7.4	0.0	Medium	Medium
Cleveland-54	616	77.8	1057	5.9	...	Medium	Heavy
Half & Half	596	76.7	902	12.7	51.4	Medium	Medium
Dixie-Triumph	646	75.3	1129	5.3	0.0	Large	Medium
Mebane Triumph	559	54.4	681	12.9	21.9	Medium	Heavy
Rowden 40	600	60.5	880	7.6	0.0	Large	Heavy
Acala-37	612	76.1	1000	10.6	...	Large	Heavy
D. & P. L. No. 4	602	76.4	1021	10.8	4.3	Medium	Heavy
D. & P. L. No. 4-8	610	76.3	1103	9.0	5.3	Medium	Heavy
Stoneville No. 2	655	71.6	1124	6.2	2.6	Small	Light
Delfos 6102-911	644	86.1	1403	11.8	...	Small	Light
Delfos 6102-A2C3	600	88.3	1420	10.4	21.3	Small	Light
Missdel No. 2	622	89.6	1598	13.8	22.8	Small	Light
Missdel No. 1	520	66.1	1038	9.9	12.5	Small	Medium
Delfos No. 2	620	81.0	1058	8.0	...	Medium	Light
Express-317	638	80.4	1177	6.6	1.0	Large	Light
D. & P. L. No. 6	699	85.5	1041	7.3	0.5	Large	Light
Wilds No. 2	626	76.4	989	15.9	11.3	Small	Heavy
Deltatype 8	575	61.4	1071	22.4	16.7	Small	Heavy

COTTON VARIETY STUDIES ON BLUFF LAND, BATON ROUGE, 1929

The Bluff Land cotton variety test in 1929, (see Table III), was conducted on the same land as used the two years previously. This land has been built up with legumes and fertilizers during the past few years so that it produces a moderately heavy growth of cotton plants. Fertilization consisted of 300 pounds of superphosphate, 50 pounds of nitrate of soda, and 50 pounds of sulphate of potash applied to the row several days ahead of planting and 150 pounds of nitrate of soda, in addition, applied as a side dressing after the cotton was chopped out.

The cotton was planted April 18. The weather during the entire month of April was very seasonable. As a result, a splendid stand was obtained. The seed germinated quickly and young plants grew off well. There was no serious loss of plants due to damping off diseases like there frequently is. The weather continued very seasonable until July when daily showers became common. These made weevil control difficult.

There was a heavy initial infestation of boll weevils but they were controlled rather successfully by presquare poisoning. Four other applications of poison were made during July. This controlled the weevils fairly well during July but when the seasonal migration occurred the first part of August weevils did considerable damage, especially to small bolls. Plant lice became rather plentiful during the latter part of July. One application of nicotine sulphate in calcium arsenate was made without much effect apparently. This treatment is effective, however, under favorable conditions.

Cotton wilt damaged considerably such susceptible varieties as Half and Half, certain strains of Delfos, Mebane Triumph, Wilds and Deltatype Webber. Boll counts indicated that these same varieties also had a higher percentage of boll rot.

The rank of varieties shown in the table is very similar to results obtained during the two previous years. A variety that has a high average rank for the three years must be a good variety for local planting, or for planting anywhere where similar conditions prevail.

The lint prices used in Table III, and in other tables, are based on the New Orleans spot cotton market for November 29, white cotton, middling grade. Cotton seed was valued at $30.00 a ton.

TABLE V
SECOND VARIETY TEST
Bluff Land, Baton Rouge, 1929

Row No.	Variety	Seed Cotton per Acre	% Lint	Lint per Acre	Length of Staple	Value of Staple per Pound	Value of Seed & Lint	Rank in Value 1929	Bolls per Pound
1	Wann. Cleveland........	1016	36.7	372	7-8	17.17	73.53	19	73
2	Piedmont Cleveland.....	1280	34.7	444	15-16	17.47	90.10	11	65
3	Rhynes Cook...........	1099	36.0	395	7-8	17.17	78.38	17	73
4	Cook 1010-519 S.P.S.C...	1064	40.1	426	7-8	17.17	82.71	14	75
5	Stoneville No. 1-690.....	1116	36.5	407	1 1-32	18.67	86.61	13	62
6	Stoneville.... No. 1....	1073	34.2	366	1 1-16	18.92	79.84	16	65
7	Lankart................	857	37.7	323	1 1-16	18.92	69.12	20	53
8	Wacona................	970	34.6	336	1 3-32	19.27	74.25	18	57
9	Salsbury-68............	1260	33.7	425	1 1-16	18.92	92.93	7	77
10	Coker's Clev. 5-2........	1086	35.2	382	1	18,17	79.96	15	76
11	Wann. Staple Clev.......	1188	35.9	426	1 1-32	18.67	90.96	10	71
12	Delfos-6102-A2C3.......	1219	33.8	412	1 1-8	19.42	92.11	8	87
13	Delfos-6102-2323........	1240	33.3	413	1 3-16	20.67	97.76	4	81
14	Delfos-6102-654.........	1397	33.3	465	1 1-8	19.42	104.28	2	77
15	Delfos-6102-625.........	1258	33.8	425	1 3-32	19.27	94.38	6	82
16	Delfos-6102-675.........	1293	34.3	443	1 3-32	19.27	98.11	3	83
17	Delfos-6102-668.........	1434	32.7	469	1 1-8	19.42	105.54	1	77
18	Delfos-6102-2103........	1192	33.9	404	1 3-16	20.67	95.32	5	81
19	Delfos-631-463..........	1197	34.2	409	1 1-8	19.42	91.24	9	79
20	Lightning Express-7.....	1192	32.6	389	1 1-8	19.42	87.58	12	81
21	Greer Witchita..........	924	30.0	277	1 3-16	20.67	66.95	21	62

This test was planted near the same time that the test reported in Table III was planted and conditions under which the cotton was grown were very similar.

TABLE VI

COTTON VARIETY TEST

Alluvial Land, Baton Rouge, La., 1929

Variety	Seed Cotton per Acre	% Lint	Lint per Acre	Length of Staple	Value of Staple per lb.	Value of Seed & Lint	Rank in Value 1929	3 yr. Av. in Rank
1. Wann. Cleveland........	1107.4	36.6	405	15-16	17.47	81.29	20	13.6
2. Marett's Cleveland-7....	1144.5	36.0	412	1	18.17	85.85	17	....
3. Wilson Cleveland.......	1619.7	34.0	551	15-16	17.47	112.29	5	*7.0
4. Cleveland-54...........	1462.8	34.5	505	15-16	17.47	102.59	11	*11.5
5. Half & Half............	1358.1	43.2	587	7-8	17.17	112.35	4	10.0
6. Dixie Triumph..........	1672.1	34.1	570	15-16	17.47	116.11	1	7.3
7. Mebane Triumph.......	1146.7	37.7	432	1 1-32	18.67	91.37	14	19.6
8. Rowden-40.............	1558.7	33.1	516	1	18.17	109.40	8	....
9. Acala-37...............	1118.3	35.9	401	1	18.17	83.62	18	†22.0
10. D. & P. L. No. 4........	1105.3	34.6	382	1	18.17	80.26	22	17.6
11. D. & P. L. No. 4-8......	1037.7	38.4	398	1	18.17	81.91	19	16.0
12. Stoneville No. 2.........	1190.3	33.7	401	1 1-16	18.92	87.71	16	6.6
13. Stoneville No. 1.........	1480.2	33.9	502	1	18.17	103.61	10	6.6
14. Lone Star Express-42....	1510.7	32.5	491	1 1-16	18.92	103.99	9	*13.0
15. Delfos 6102-625.........	1403.9	31.2	438	1 3-32	19.27	94.42	13	..
16. Delfos 6102-A2C3.......	1536.9	31.9	490	1 5-32	20.04	112.87	2	5.3
17. Missdel No. 2...........	1449.7	33.5	486	1 5-32	20.04	112.69	3	....
18. Missdel No. 1...........	1421.4	33.3	473	1 3-16	20.67	112.26	6	....
19. Delfos No. 2............	1554.3	31.8	494	1 1-8	19.42	111.64	7	*4.0
20. Express-317............	1242.6	33.5	416	1 3-16	20.67	100.44	12	8.5
21. D. & P. L. No. 6........	1111.8	33.5	372	1 3-16	20.67	91.12	15	9.0
22. Wilds No. 2............	967.9	31.0	300	1 7-32	21.67	80.91	21	*22.0

* Two year average. † A different strain was used in 1927 and 1928.

ALLUVIAL LAND COTTON VARIETY STUDIES

BATON ROUGE, LA., 1929

The Alluvial Land cotton variety test was conducted on rather low river land which is classed as Sharkey clay loam. The land was only moderately fertile. It was in cotton the two years previously. No fertilizer was used either year.

The season during 1929 was very favorable for cotton except that during July and part of August afternoon showers were so frequent that it was a difficult matter to control boll weevils.

The cotton was planted April 12, and as nearly perfect a stand obtained as could be hoped for. The plants made good growth but did not become rank. They fruited well.

Boll weevils were present in numbers before the squares were large enough to puncture. A pre-square poisoning apparently did considerable good but weevils kept coming in such numbers that it was necessary to continue poisoning throughout July. Six heavy applications of calcium arsenate were made. This did not control the weevils thoroughly but it kept them from making rapid increase in number. A good crop was made in spite of the weevils.

There was but very little damage from fungus diseases such as wilt and boll rot.

As was mentioned above, the yields in the 1929 test were very good, many of the better varieties making about a bale to the acre. Varieties of the Delfos type again ranked high and made the best showing on a three year average. There seems to be no question but that they are best for alluvial land in Louisiana where cotton tends to grow too rank, and where weevils and summer rains are both abundant.

TABLE VII

COOPERATIVE COTTON VARIETY TEST

at Raceland, Lafourche Parish, 1929

Ridgeland Co., Plantation Owners; V. A. Guidroz, County Agent and Louisiana Experiment Station Cooperating.

Variety	Seed Cotton per Acre	% Lint	Lint per Acre	Length of Staple	Value of Staple per lb.	Value of Seed & Lint	Rank in Value 1929
1. Wann. Cleveland	387.2	36.6	142	15–16	17.47	28.49	19
2. Wilson Cleveland	471.9	36.0	170	15–16	17.47	34.23	15
3. Half & Half	447.7	43.2	193	7–8	17.17	36.97	12
4. Dixie-Triumph	612.3	34.1	209	15–16	17.47	42.56	10
5. Mebane Triumph	261.4	37.7	99	1 1-32	18.67	20.91	20
6. Rowden-40	508 2	33.1	168	1	18.17	35.63	14
7. Acala-37	447.7	35.9	161	1	18.17	33.56	16
8. D. & P. L. No. 4	450.1	34.6	156	1	18.17	32.76	17
9. D. & P. L. No. 4-8	467.1	38.4	179	1	18.17	36.84	13
10. Stoneville No. 2	660.7	33.7	223	1 1-16	18.92	48.76	8
11. Stoneville No. 1	534.8	33.9	181	1	18.17	38.20	11
12. Lone Star X Express-42	769.6	32.5	250	1 1-16	18.92	55.10	5
13. Delfos -911	648.6	31.6	205	1 5-32	20.04	47.74	9
14. Delfos-6102-A2C3	822.8	31.9	262	1 5-32	20.04	60.91	2
15. Missdel No. 2	701.8	33.5	235	1 5-32	20.04	54.10	6
16. Missdel No. 1	660.7	33.3	220	1 3-16	20.67	52.09	7
17. Delfos No. 2	912.3	31.8	290	1 1-8	19.42	65.65	1
18. Express-317	762.3	33.5	255	1 3-16	20.67	60.31	3
19. D. & P. L. No. 6	721.2	33.5	242	1 3-16	20.67	57.21	4
20. Wilds No. 2	399.3	31.0	124	1 7-32	21.67	31.00	18

COTTON VARIETY STUDIES AT RACELAND, LAFOURCHE PARISH, 1929

The Raceland cotton variety test was conducted on land belonging to the Ridgeland Company, located about 5 miles southwest of Raceland. The soil is classed as Sharkey clay and is rather low and fertile, but the particular plats used were not very uniform.

The cotton was planted May 7, and a splendid stand secured. Boll weevils did not appear until rather late but did considerable damage because the cotton was late. No poison was used.

The yields shown in Table VII on another page are only fair. With earlier planting and weevil control they doubtless would have been much better. The leading varieties, considering the value of their product, are nearly all of the Delfos type. The indications are that this is the best variety to plant in this section. It is prolific and quick-making, has a light foliage and the plants do not become as rank as the plants of some other varieties.

TABLE VIII
COOPERATIVE COTTON VARIETY TEST

Crowley, La., 1929

J. M. Jenkins, Superintendent Rice Experiment Station and Louisiana Experiment Station Cooperating.

Variety	Seed Cotton per Acre	% Lint	Lint per Acre	Length of Staple	Value of Staple per lb.	Value of Seed & Lint	Rank in Value 1929	Average Rank for 2 years
1. Wann. Cleveland....	602	36.6	220	15–16	17.47	44.16	7	12.5
2. Marett's Cleveland-7	560	36.0	202	1	18.17	42.07	11	....
3. Wilson Cleveland...	714	34.0	243	15–16	17.47	49.52	3	6.0
4. Cleveland 54.......	612	34.5	211	15–16	17.47	42.88	9	....
5. Half & Half........	532	43.2	230	7–8	17.17	44.02	8	11.5
6. Dixie Triumph......	668	34.1	228	15–16	17.47	46.43	6	9.0
7. Mebane Triumph...	490	37.7	185	1 1-32	18.67	39.12	17	16.5
8. Rowden-40.........	542	33.1	179	1	18.17	37.97	20	20.0
9. Acala-37...........	553	35.9	199	1	18.17	41.47	15	....
10. D. & P. L. No. 4....	570	34.6	197	1	18.17	41.39	14	8.0
11. D. & P. L. No. 4-8..	637	38.4	245	1	18.17	50.40	2	5.0
12. Stoneville No. 2.....	665	33.7	224	1 1-16	18.92	49.00	4	5.0
13. Delfos-911..........	581	31.6	184	1 5-32	20.04	42.83	10	....
14. Delfos-6102-A2C3...	626	31.9	200	1 5-32	20.04	46.47	5	3.0
15. Missdel No. 2.......	539	33.5	181	1 5-32	20.04	41.64	12	....
16. Missdel No. 1.......	507	33.3	169	1 3-16	20.67	40.00	16	....
17. Delfos No. 2........	577	31.8	183	1 1-8	19.42	41.45	13	....
18. Express-317........	651	33.5	218	1 3-16	20.67	51.56	1	10.0
19. D. & P. L. No. 6....	486	33.5	163	1 3-16	20.67	38.54	19	12.0
20. Wilds No. 2........	500	31.0	155	1 7-32	21.67	38.77	18	....

COTTON VARIETY STUDIES AT CROWLEY, LA., 1929

The Crowley cotton variety test was conducted in cooperation with J. M. Jenkins, Superintendent of the Rice Experiment Station, on rented land adjoining the Experiment Station. This land is prairie loam soil, known as Crowley Silt Loam. The particular piece used is old rice land typical of the greater portion of the soil in the Crowley area, and considered rather low in plant food available for highland crops. Fertilization: 474 pounds per acre of a complete fertilizer consisting of 300 pounds super-phosphate, 150 pounds nitrate of soda, and 24 pounds sulphate of potash was applied before planting.

The cotton was planted April 16, and germinated about two weeks later. Stands were only fair. Boll weevils appeared early and did considerable damage although the cotton was given six applications of calcium arsenate poison. The plants attained a moderate size but were not fruited very well.

The fact that there has been considerable difference in the performance of varieties the two years grown, and some difference in their showing here and elsewhere when grown under similar conditions, may be taken as an indication that it will be necessary to conduct the experiment for a longer period of years before a very definite opinion can be formed concerning the merits of the different varieties for this type of land. Delfos-6102-A$_2$C$_3$, D. & P. L. No. 4 - 8, Stoneville No. 2, and Wilson Cleveland have the best average record and are probably among the most satisfactory varieties obtainable. Express-317, which ranked first in 1929, is a prolific, vigorous-growing variety with good lint characters. It did well in many tests in 1929 and looks as if it might be well adapted to the Crowley lands.

TABLE IX
COOPERATIVE COTTON VARIETY TEST
at DeRidder, Beauregard Parish, 1929.

I. R. Smith, Plantation Owner; M. L. Cooper, County Agent and Louisiana Experiment Station Cooperating.

Variety	Seed Cotton per Acre	% Lint	Lint per Acre	Length of Staple	Value of Staple per lb.	Value of Seed & Lint	Rank in Value 1929
1. Wann. Cleveland	373.4	36.6	136.7	7–8	17.17	27.02	18
2. Marett's Cleveland-7	290.4	36.0	104.5	1	18.17	21.79	20
3. Wilson Cleveland	484.1	34.0	164.6	7–8	17.17	33.05	8
4. Cleveland-54	373.4	34.5	128.8	7–8	17.17	25.78	19
5. Half & Half	366.5	43.2	158.3	13–16	16.67	29.51	16
6. Dixie Triumph	511.7	34.1	174.5	15–16	17.47	35.55	5
7. Mebane Triumph	408.0	37.7	153.8	31–32	17.82	31.22	12
8. Rowden 40	567.0	33.1	187.7	1	18.17	39 80	1
9. Acala-37	414.9	35.9	148.9	1 1-16	18.92	32.16	10
10. D. & P L No. 4	442.5	34.6	153.1	15–16	17.47	31.09	13
11. D. & P. L. No. 4-8	380.3	38.4	146.0	1	18.17	30.05	15
12. Stoneville No. 2	421.8	33.7	142.1	1 3-32	19.27	31.58	11
13. Delfos-911	435.6	31.6	137.6	1 3-16	20.67	32.91	9
14. Delfos-6102-A2C3	463.3	31.9	147.8	1 5-32	20.04	34.35	6
15. Missdel No. 2	456.3	33.5	152.9	1 1-8	19.42	34.24	7
16. Missdel No. 1	394.1	33.3	131.2	1 3-16	20.67	31.06	14
17. Delfos No. 2	504.7	31.8	160.5	1 5-32	20.04	37.32	2
18. Express-317	470.2	33.5	157.5	1 5-32	20.04	36.25	3
19. D. & P. L. No. 6	366.4	33.5	122.7	1 3-16	20.67	29.02	17
20. Wilds No. 2	449.4	31.0	139.3	1 1-4	22.67	36.23	4
21. *Egyptian Red Leaf	318.1						

* None of this variety ginned for lint sample.

COTTON VARIETY TEST AT DE RIDDER, 1929

The DeRidder cotton variety test was conducted on the farm of I. R. Smith, located ten miles west of DeRidder in Beauregard Parish. The land used is classed as Susquehannah fine sandy loam. It is ridge land, better drained than most of the land of that part of the State and probably more fertile naturally. Most of the ridge land is in cultivation while much of the other is lying out.

The cotton in the variety test was fertilized with a side dressing of commercial fertilizers, but, under the dry weather conditions prevailing, it was applied too late to be of much help. The cotton plants did not get to be large enough to bear much cotton.

The cotton was planted April 12, and came up to a good stand. On account of dry weather during the season there was but very little damage from boll weevils, other cotton insects, or from fungus diseases.

The yields shown in the table are low. They would doubtless have been much better under more favorable weather conditions and heavier or more effective fertilization.

It will be necessary to conduct the experiment for a longer period before a very definite opinion can be formed concerning the merits of the different varieties for this type of land. Apparently, though, a vigorous growing, prolific cotton is needed.

TABLE X

COOPERATIVE COTTON VARIETY TEST

Melrose, Natchitoches Parish, 1929
John Henry, Plantation Owner; Guy Fletcher, County Agent and
Louisiana Experiment Station Cooperating.

Variety	Seed Cotton per Acre	% Lint	Lint per Acre	Length of Staple	Value of Staple per lb.	Value of Seed & Lint	Rank in Value
1. Wann. Cleveland	717.5	36.6	263	7–8	17.17	51.97	18
2. Marett's Cleveland-7	833.7	36.0	300	1	18.17	62.52	12
3. Wilson Cleveland	1132.5	34.0	385	7–8	17.17	77.32	4
4. Cleveland-54	862.7	34.5	298	7–8	17.17	59.58	13
5. Half & Half	720.0	43.2	311	13–16	16.67	57.97	16
6. Dixie Triumph	1086.6	34.1	371	15–16	17.47	75.55	7
7. Mebane Triumph	338.8	37.7	128	1	18.17	26.42	20
8. Rowden-40	848.2	33.1	281	1	18.17	59.57	14
9. Acala-37	775.6	35.9	278	1	18.17	57.98	15
10. D. & P..L No. 4	774.4	34.6	268	1	18.17	56.29	17
11. D. & P. L. No. 4-8	988.6	38.4	380	15–16	17.47	75.52	8
12. Stoneville No. 2	971.6	33.7	327	1 1-16	18.92	71.54	10
13. Delfos-911	1032.1	31.6	326	1 5-32	20.04	75.92	6
14. Delfos-6102-A2C3	1062.4	31.9	339	1 1-8	19.42	76.68	5
15. Missdel No. 2	1165.2	33.5	390	1 1-8	19.42	87.37	2
16. Missdel No. 1	976.5	33.3	325	1 5-32	20.04	74.90	9
17. Delfos No. 2	1183.4	31.8	376	1 1-8	19.42	85.13	3
18. Express-317	1198.0	33.5	401	1 5-32	20.04	92.32	1
19. D. & P. L. No. 6	854.3	33.5	286	1 5-32	20.04	65.84	11
20. Wilds No. 2	526.4	31.0	163	1 3-16	20.67	39.14	19

COTTON VARIETY STUDIES AT MELROSE, 1929

The Melrose cotton variety tests were conducted on the J. H. Henry plantation, which is located on Cane River about 18 miles southeast of Natchitoches. The land used was rather fertile sandy loam soil. Plants made medium rank growth. The cotton was planted April 26, and came up to a fair stand. The weather was seasonable except that showers during the time cotton was fruiting caused some shedding and interfered with weevil control. The cotton was damaged considerably by weevils although five applications of calcium arsenate were made. Probably most of this was applied too early for most efficient results. Wilt damaged Half and Half, some strains of Delfos, Wilds and other of the more susceptible varieties.

Yields, lint percentages, staple length, etc., are shown in the Table X. The yields are not high but the performances of the different varieties seems to be rather consistent. The ones that made the best showing are about the same as the ranking varieties in other tests where conditions were similar. From the test it appears that Express-317, Missdel No. 2, Delfos No. 2, Delfos 6102-A_2C_3, and Wilson Cleveland are the most profitable varieties to plant in this section. Another season's test might show a slightly different ranking but most of these varieties would rank high if conditions were similar to the ones prevailing the past season. D. & P. L. No. 8 is a good short staple variety and Dixie-Triumph is a splendid variety for wilty soil.

TABLE XI
COTTON VARIETY TEST
Natchitoches, La., 1929
Louisiana State Normal and State Experiment Station Cooperating

Variety	Seed Cotton per Acre	% Lint	Lint per Acre	Length of Staple	Value of Staple per lb.	Value of Seed & Lint	Rank in Value
1. Wann. Cleveland	1536	36.6	562	7-8	17.17	111.11	14
2. Marett's Cleveland	1568	36.0	564	1	18.17	117.54	10
3. Wilson Cleveland	1984	34.0	675	7-8	17.17	135.53	1
4. Cleveland No. 54	1584	34.5	546	7-8	17.17	109.32	15
5. Cleveland Big Boll*	1184						
6. Half & Half	1584	43.2	684	13-16	16.67	127.52	8
7. Dixie Triumph	1872	34.1	638	15-16	17.47	129.97	5
8. Mebane Triumph	976	37.7	368	1	18.17	75.99	21
9. Rowden-40	1632	33.1	540	1	18.17	114.50	13
10. Acala-37	1328	35.9	477	1	18.17	99.43	18
11. D. & P. L. No. 4	1616	34.6	559	1	18.17	117.42	11
12. D. & P. L. No. 4-8	1696	38.4	651	15-16	17.47	129.40	7
13. Stoneville No. 2	1760	33.7	593	1 1-16	18.92	129.70	6
14. Delfos-911	1776	31.6	561	1 5-32	20.04	130.64	4
15. Delfos-6102-A2C3	1856	31.9	592	1 1-8	19.42	133.93	2
16. Missdel No. 2	1376	33.5	461	1 1-8	19.42	103.25	16
17. Missdel No. 1	1328	33.3	442	1 5-32	20.04	101.87	17
18. Delfos No. 2	1600	31.8	509	1 1-8	19.42	115.21	12
19. Express-317	1616	33.5	541	1 5-32	20.04	124.54	9
20. D. & P. L. No. 6	1696	33.5	568	1 5-32	20.04	130.75	3
21. Wild's No. 2	1040	31.0	322	1 3-16	20.67	77.33	20
22. Greer-Wichita	1232	30.8	379	1 5-32	20.04	88.74	19

*None of this variety ginned for lint per cent.

COTTON VARIETY STUDIES AT NATCHITOCHES, 1929

The cotton variety test at Natchitoches, which was under the supervision of Professor A. A. Fredericks, was conducted on land belonging to the State Normal College and located in the Cane River bottoms near the city. The land used was rather fertile due to legumes that had been grown previously. It will be observed that the yields shown in the accompanying table are unusually good. It will be noted, too, that the comparative ranking of the varieties grown is very similar to the ranking in the tests at Dixie and at Melrose, two other tests made in the Red River valley.

TABLE XII

COOPERATIVE COTTON VARIETY TEST

at Dixie, Caddo Parish, 1929.

W. H. North, Plantation Owner; J. B. Anthony, County Agent and Louisiana Experiment Station Cooperating.

Varieties	Seed Cotton per Acre	% Lint	Lint per Acre	Length of Staple	Value of Staple per lb.	Value of Seed and Lint	Rank in Value 1929	3 yr. Average in Rank
1. Wann. Cleveland....	957.1	36.6	350.3	7–8	17.17	69.25	12	10.3
2. Marett's Cleveland-7	856.6	36.0	308.4	1	18.17	64.26	16	....
3. Wilson Cleveland...	1306.8	34.0	444.3	7–8	17.17	89.22	1	2.6
4. Half & Half........	866.4	43.2	374.3	13–16	16.67	69.78	11	11.3
5. Dixie-Triumph......	1204.0	34.1	410.6	15–16	17.47	83.63	6	5.3
6. Mebane Triumph...	451.3	37.7	170.1	1	18.17	35.13	21	20.6
7. Lankart............	496.1	37.9	188.0	1 1-16	18.92	40.19	20	....
8. Wacona............	781.7	33.0	258.0	13-32	19.27	57.57	19	....
9. Rowden-40.........	977.7	33.1	323.6	1	18.17	68.61	13	*7.0
10. Acala-37...........	1007.9	35.9	361.8	1	18.17	75.43	10	†15.0
11. D. & P. L. No. 4....	926.9	34.6	320.7	1	18.17	67.36	15	9.6
12. D. & P. L. No. 4-8..	1000.7	38.4	384.3	1	18.17	79.07	8	4.6
13. Stoneville No. 2.....	1136.2	33.7	382.9	1 1-16	18.92	83.74	5	*6.0
14. Delfos-6102-A2C3...	1211.2	31.9	386.4	1 1-8	19.42	87.41	2	11.0
15. Missdel No. 2......	1006.7	33.5	337.2	1 1-8	19.42	75.53	9	....
16. Missdel No. 1.......	826.4	33.3	275.2	1 5-32	20.04	63.42	17	....
17. Delfos No. 2........	1168.9	31.8	371.7	1 1-8	19.42	84.14	4	7.3
18. Express-317........	1119.2	33.5	374.9	1 5-32	20.04	86.29	3	*4.5
19. Delfos 631-463......	1109.6	32.2	357 3	1 1-8	19.42	80.67	7	....
20. Wilds No. 2........	916.0	31.0	284.0	1 3-16	20.67	68.18	14	....
21. Greer Witchita.....	860.3	30.8	265.0	1 5-32	20.04	62.04	18	....

* Two year average.

† A different strain of Acala was used in 1927 and 1929.

COTTON VARIETY STUDIES AT DIXIE, 1929

The Dixie cotton variety studies were made on the plantation belonging to W. H. North, located in the Red River valley, about fifteen miles north of Shreveport. The land used was of the lighter sandy type of valley soil and was moderately fertile. The weather during the cotton growing period was fairly seasonable. Plants became rather rank, due probably to a large supply of nitrogen in the soil.

Cotton was planted April 29 and a good stand secured. Boll weevils appeared in some numbers during July. Late in the month, three applications of poison were made with an airplane. There was considerable wilt in some of the more susceptible varieties like Half & Half.

The yields, it will be noticed in the accompanying table, were fairly good but below the yields of the previous year. Wilson Cleveland (Collins' Cleveland) again ranked high in the test and appears to be well adapted to the region. Express-317, Delfos No. 2, and Stoneville No. 2 all ranked well and have a good average for the two or three years that they have been grown. They are prolific and possess some wilt resistance, which makes them better suited to this land than several other varieties listed. Delfos-6102-A_2C_3 ranked high in 1929, but its average for the three years is not so good. It is too susceptible to wilt to be adapted to this soil.

TABLE XIII

COOPERATIVE COTTON VARIETY TEST

at Homer, Claiborne Parish, 1929.

Atkins Bailey, Plantation Owner; Brodie Pugh, County Agent and Louisiana Experiment Station Cooperating.

Variety	Seed Cotton per Acre	% Lint	Lint per Acre	Length of Staple	Value of Staple per lb.	Value of Seed & Lint	Rank in Valeu 1929
1. Wann. Cleveland	766.2	36.6	280.4	7–8	17.17	55.53	14
2. Marett's Cleveland-7	645.2	36.0	232.3	1	18.17	48.40	18
3. Wilson Cleveland	832.3	34.0	283.0	7–8	17.17	56.83	11
4. Half & Half	717.8	43.2	310.1	13–16	16.67	57.81	10
5. Super Seven	722.6	32.0	231.2	1 1-16	18.92	51.11	16
6. Dixie Triumph	838.8	34.1	286.0	15–16	17.47	58.25	8
7. Mebane Triumph	480.7	37.7	181.2	31–32	17.82	36.78	20
8. Rowden-40	806.5	33.1	267.0	1	18.17	56.60	12
9. Acala-37	750.0	35.9	269.2	1 1-16	18.92	58.14	9
10. D. & P. L. No. 4	685.5	34.6	237.2	15–16	17.47	48.17	19
11. D. & P. L. No. 4-8	795.2	38.4	305.4	1	18.17	62.84	2
12. Cleveland No. 5	754.9	36.2	273.3	1 1-8	19.42	60.29	6
13. Stoneville No. 2	742.0	33.7	250.1	1 3-32	19.27	55.57	13
14. Delfos-6102-A2C3	835.5	31.9	266.5	1 5-32	20.04	61.95	5
15. Missdel No. 2	801.7	33.5	268.6	1 1-8	19.42	60.16	7
16. Missdel No. 1	796.8	33.3	265.3	1 3-16	20.67	62.81	3
17. Delfos No. 2	838.8	31.8	266.7	1 5-32	20.04	62.03	4
18. Express-317	908.1	33.5	304.2	1 5-32	20.04	70.02	1
19. D. & P. L. No. 6	653.3	33.5	218.9	1 3-16	20.67	51.77	15
20. Wilds No. 2	621.0	31.0	192.5	1 1-4	22.67	50.07	17

COTTON VARIETY STUDIES AT HOMER, 1929

The Homer cotton variety test was conducted on the farm of Atkins Bailey, located in Claiborne Parish, five miles south of Homer. The land used is classed as Ruston fine sandy loam and is rather low in fertility, naturally. This land, in its natural state, is fairly typical of a large part of the hill land of North Louisiana but Mr. Bailey grows legumes and cover crops and keeps his land well terraced so that its condition is better than average land of the section. Preceding this cotton crop there was a good cover crop of rye turned under later in the season, and 350 pounds of a 9-6-3 fertilizer applied.

Unseasonably dry weather prevailed during most of the season. This prevented cotton plants from becoming large, and interfered with their fruiting.

The cotton was planted May 14 and 15. This was rather late but the seed germinated at once and cotton came up to a good stand. The young plants grew off well.

Boll weevils appeared during July but did not become numerous enough to merit poisoning. Fungus diseases caused practically no loss.

The accompanying table gives the most important features in connection with each variety used in the test. It will be observed that the yields are only fair. This was due, in part at least, to the dry weather experienced. Four of the five ranking varieties were long staple varieties. These varieties not only ranked high in value, which was increased to some extent by the premium placed on staple cottons, but they ranked high in production of lint, due to their earliness and prolificness. In general this section of the State is better adapted to growing short staple varieties. D. & P. L. No. 8 appears to be a very satisfactory variety. If the land is badly infected with wilt, Dixie-Triumph is a good variety to plant.

TABLE XIV
COOPERATIVE COTTON VARIETY TEST
at Calhoun, La., 1929.

Sidney Stewart, Superintendent North Louisiana Experiment Station and Louisiana Experiment Station Cooperating.

Variety	Seed Cotton per Acre	% Lint	Lint per Acre	Length of Staple	Value of Staple per lb.	Value of Seed & Lint	Rank in Value	3 Yr. Average in Rank
1. Wann. Cleveland....	1460	36.6	534	7–8	17.17	105.57	19	21
2. Marett's Cleveland-7	1460	36.0	526	1	18.17	109.58	18	..
3. Wilson Cleveland...	1874	34.0	637	7–8	17.17	127.93	6	14
4. Cleveland-54.......	1640	34.5	566	7–8	17,17	113.29	15	..
5. Half & Half........	1550	43.2	670	13–16	16.67	124.88	10	16
6. Dixie-Triumph......	1764	34.1	602	15–16	17.47	122.59	11	12
7. Mebane Triumph...	1190	37.7	449	31 -32	17.82	91.13	21	23
8. Rowden-40.........	1660	33.1	549	1	18.17	116.42	14	*11
9. Acala-37...........	1530	35.9	549	1 1-16	18.92	118.59	13	13
10. D. & P. L. No. 4....	1600	34.6	554	15–16	17.47	112.47	16	11
11. D. & P. L. No. 4-8..	1760	38.4	676	1	18.17	139.08	2	5
12. Stoneville No. 2.....	1740	33.7	586	1 3-32	19.27	130.38	4	*7
13. Delfos-911..........	1824	31.6	576	1 3-16	20.67	137.77	3	7
14. Delfos-910..........	1690	32.0	541	1 5-32	20.04	126.08	8	*14
15. Delfos-6102-A2C3...	1634	31.9	521	1 5 32	20.04	121.11	12	7
16. Missdel No. 2.......	1680	33.5	563	1 -1-8	19.42	126.09	7	4
17. Missdel No. 1.......	1404	33.3	468	1 3-16	20.67	110.78	17	..
18. Delfos No. 2........	1954	31.8	621	1 5-32	20.04	144.45	1	..
19. Express-317........	1624	33.5	544	1 5-32	20.04	125.22	9	*5
20. D. & P. L. No. 6....	1640	33.5	549	1 3-16	20.67	129.85	5	6
21. Wilds No. 2....... ..	1300	31.0	403	1 1-4	22.67	104.82	20	..

* Two year average.

COOPERATIVE COTTON VARIETY TEST AT CALHOUN, 1929

The Calhoun cotton variety test was conducted on the North Louisiana Experiment Station farm on land fairly typical of the region except that the area used was nearly level and more fertile than average land in North Louisiana. The plats were treated with a moderate application of a complete fertilizer before planting. The stands secured were good but there was some difference in number of plants per row for different varieties. There was practically no wilt or boll rot, and little weevil injury, due to the fact that the cotton was poisoned for protection.

It will be noted in the accompanying table that the yield of most varieties was good, especially for the section of the State where the test was made. With sufficient fertilizers, good culture, and a good variety, a satisfactory crop can be made.

The results obtained at the Calhoun Station the past three years show high rank for certain staple varieties. It is probable, though, that on the poorer lands of the section that a more vigorous growing short staple cotton will be the most profitable. Delfos No. 2 and Express-317 are among the most vigorous growing of the staple varieties. Dixie-Triumph is a good variety to grow on land where cotton rusts and wilts badly. D. & P. L. No. 4-8 is a good hill land variety. It has a good length for a short cotton, has a good lint percentage, and is fairly disease resistant and productive.

TABLE XV
COOPERATIVE COTTON VARIETY TEST

Monroe, Ouachita Parish, 1929.

N. W. McHenry, Plantation Owner; E. R. Strahan, County Agent and Louisiana Experiment Station Cooperating.

Variety	Seed Cotton per Acre	% Lint	Lint per Acre	Length of Staple	Value of Staple per lb.	Value of Seed & Lint	Rank in Value 1929	Average Rank for 3 years
1. Wann. Cleveland....	1001.9	36.6	367	7–8	17.17	72.54	14	14.6
2. Wilson Cleveland...	1282.6	34.0	436	7–8	17.17	87.56	7	5.3
3. Cleveland-54........	1264.5	34.5	436	7–8	17.17	87.29	8	..
4. Half & Half.	695.8	43.2	301	13–16	16.67	56.10	18	19.3
5. Dixie-Triumph..... .	1312.9	34.1	448	15–16	17.47	91.24	5	6.0
6. Dixie-14............	1355.2	36.0	488	15–16	17.47	98.26	2	3.3
7. Mebane Triumph...	701.8	37.7	265	1	18.17	54.70	20	16.0
8. Lankart............	813.1	37.9	308	1 1-16	18.92	65.85	16	..
9. Rowden-40.........	1325.0	33.1	439	1	18.17	93.06	4	*6.5
10. Acala-37...........	959.5	35.9	344	1	18.17	71.74	15	†7.6
11. D. & P. L. No. 4....	1185.8	34.6	410	1	18.17	86.13	9	7.6
12. D. & P. L. No. 4-8..	1064.8	38.4	409	1	18.17	84.15	10	*9.0
13. Stoneville No. 2.....	1210.0	33.7	408	1 1-16	18.92	89.22	6	*8.0
14. Delfos-6102-A2C3...	792.6	31.9	253	1 1-8	19.42	57.23	17	17.0
15. Missdel No. 2.......	742.9	33.5	249	1 1-8	19.42	55.76	19	..
16. Delfos-631-463......	1001.9	32.2	323	1 1-8	19.42	72.91	13	..
17. Missdel No. 1.......	998.3	33.3	332	1 5-32	20.04	76.53	11	..
18. Express-317........	1470.2	33.5	493	1 5-32	20.04	113.46	1	*1.0
19. D. & P. L. No. 6....	1254.8	33.5	420	1 5-32	20.04	96.69	3	6.0
20. Wilds No. 2........	980.1	31.0	304	1 3-16	20.67	72.98	12	11.5

* Two year average. † A different strain of Acala was used in 1927 and 1928.

COTTON VARIETY STUDIES AT MONROE, 1929

The Monroe cotton variety test in 1929 was planted on the McHenry Plantation, ten miles south of Monroe in the Ouachita valley. The land used has been in cultivation for many years but is still fairly productive. It is rather badly infected with the cotton wilt organism and cotton also rusts rather badly in parts of the cuts indicating a deficiency of potash. However, a liberal application of fertilizer was used.

The cotton varieties were planted April 24, and good stands secured. Weevils appeared the latter part of the season but did no great amount of damage. Cotton wilt caused considerable injury to Half & Half, the Delfos strains, Missdel, Mebane, Lankart, and other susceptible varieties.

The accompanying table shows yields and other data of interest to cotton growers. The yields are only fairly good, being considerably lower than the previous year. It will be noted, however, that about the same varieties ranked high this year that did last. Express-317 ranked first this year while last year Express-121 was first. This is a very similar strain—both being selected from the same variety. Both have considerable wilt resistance and are rather prolific. D. & P. L. No. 6 is another very similar cotton, which ranked high and has done well on Mr. McHenry's plantation when planted in large fields. Dixie-14 and Dixie-Triumph are very similar and seem to be well adapted to land such as Mr. McHenry's. They are regular wilt resistant varieties. Rowden-40 is a selection from the Texas Rowden and differs from it in having smaller bolls and in being more prolific.

TABLE XVI

COOPERATIVE COTTON VARIETY TEST

St. Joseph, La., 1929.

C. B. Haddon, Superintendent La. Delta Experiment Station and Louisiana Experiment Station Cooperating.

Varieties	Seed Cotton per Acre	% Lint	Lint per Acre	Length of Staple	Value of Lint per lb.	Value of Lint & Seed	Rank in Value
1. Wann. Cleveland...........	1506	36.6	551	7–8	17.17	108.94	20
2. Wilson Cleveland..........	1737	36.0	625	7–8	17.17	123.99	11
3. Half & Half................	1314	43.2	568	13–16	16.67	105.88	21
4. Dixie-Triumph.............	1827	34.1	623	15–16	17.47	126.90	9
5. Mebane Triumph..........	1430	37.7	539	1	18.17	111.31	19
6. Lankart....................	1499	37.9	568	1 1-16	18.92	121.44	12
7. Wacona.....................	1633	33.0	539	1 3-32	19.27	120.28	13
8. Rowden-40.................	1782	33.1	590	1	18.17	125.08	10
9. Acala-37...................	1439	35.9	517	1	18.17	111.82	16
10. D. & P. L. No. 4...........	1539	34.6	532	1	18.17	111.77	17
11. D. & P. L. No. 4-8.........	1702	38.4	654	15–16	17.47	129.97	4
12. Stoneville No. 2............	1625	33.7	548	1 1-16	18.92	119.84	14
13. Delfos-911..................	1791	31.6	566	1 5-32	20.04	131.81	3
14. Delfos-6102-A2C3..........	1788	31.9	570	1 1-8	19.42	128.96	5
15. Missdel No. 2...............	1702	33.5	570	1 1-8	19.42	127.67	8
16. Missdel No. 1...............	1676	33.3	558	1 5-32	20.04	128.59	6
17. Delfos No. 2................	1864	31.8	593	1 1-8	19.42	134.23	2
18. Express-317................	1780	33.5	596	1 5-32	20.04	137.20	1
19. D. & P. L. No. 6...........	1661	33.5	556	1 5-32	20.04	128.00	7
20. Wild's No. 2................	1500	31.0	465	1 3-16	20.67	111.65	18
21. Greer Witchita..............	1633	30.8	503	1 5-32	20.04	117.75	15

COTTON VARIETY STUDIES AT ST. JOSEPH, LA., 1929

The St. Joseph variety studies were made on the Louisiana Delta Branch Experiment Station farm located in Tensas Parish, about three miles north of St. Joseph. The land used was delta soil of the lighter sandy loam type and rather low in fertility. It was fertilized with 75 pounds of calcium cyanamid before planting and 100 pounds of nitrate of soda used as a side dressing after chopping out cotton. The cyanamid was bedded on.

The weather was unusually dry during the entire season, there being no rain of any consequence from planting time until the cotton was nearly mature. This retarded the growth of the plants and perhaps caused some shedding, but it was helpful in that it assisted in holding the boll weevils in check.

The cotton was planted May 3rd and 4th and chopped out May 22nd. Good stands were secured.

On June 24, a heavy infestation of cotton flea hoppers was observed. They did considerable damage apparently but later the plants outgrew the injury and put on a good crop of new forms. During the first part of July some weevils appeared in parts of the plats. Portions were dusted on July 3rd, and again on July 9th. This appeared to prevent the spread of the weevils to other parts of the plats until the general weevil migration took place. No serious weevil injury was experienced.

Fungus diseases caused some of the young plants to die soon after coming up but this was not extensive enough to damage stands seriously. But very little wilt or other fungus diseases appeared during the season.

The accompanying table will show the most important characteristics of each variety. It will be observed that the yields are good and that the high ranking varieties are mostly varieties that are commonly grown in the region. The first eight varieties are all, except D. & P. L. No. 4-8, of a similar type and do not differ greatly in value.

Express-317 is a selection from Express-432, a variety that was grown considerably a few years ago. It is a little more vigorous in its growth than most strains of Delfos and somewhat more disease resistant. It is a new strain and seed are not available in quantity at present. Delfos No. 2 is also a new selection that shows considerable merit, especially for some localities. It is also somewhat more vigorous and disease resistant than most strains of Delfos. Delfos-911 and Delfos-6102-A_2C_3 are standard strains of Delfos-6102. Missdel No. 1 and No. 2 are selections from Delfos-631 and Delfos-6102 respectively. They are very similar to those varieties except that they have a somewhat higher lint percentage. Most tests have shown that they are not as productive as the better strains of Delfos and have a lower total value of product. D. & P. L. No. 4-8 has a heavier foliage than the other varieties mentioned and shorter staple but is a productive and rather vigorous growing variety. It has a splendid lint percentage.

TABLE XVII

NEW STRAINS TEST

St. Joseph, La., 1929

Variety	Seed Cotton per Acre	% Lint	Lint per Acre	Length of Staple	Value of Staple per lb.	Value of Seed & Lint	Rank in Value 1929
1. Cleveland 54	1767	36.9	652	29–32	17.32	129.64	15
2. Marett's Clev. Big Boll New 5	1577	39.0	615	7–8	17.17	120.03	18
3. Marett's Cleveland 6B	1451	37.1	538	1 1-16	18.92	115.49	19
4. Cokers Clev. 884 Strain 2	1474	33.0	486	1 1-16	18.92	106.77	20
5. Rowden 2088	1873	36.5	684	1 1-32	18.67	145.52	8
6. Rowden 2119	1772	36.9	654	1 1-32	18.67	138.87	12
7. Rowden 3053	1741	35.7	622	1	18.17	129.81	14
8. Ewing's 4128A-21-32¯							
9. Ewing's 5242A-310-47¯							
10. Stoneville No. 3	1597	39.3	628	15–16	17.47	124.25	16
11. S. P. S. C. 6102x65-632	1782	36.7	654	1 5-32	20.04	147.98	6
12. Cokers Foster, Strain 4	1663	34.1	567	1 3-16	20.67	133.64	13
13. S. P. S. C. 6102-324-6207	1702	36.0	613	1 3-16	20.67	143.05	9
14. S. P. S. C. 6102-324-6106	1726	35.1	606	1 3-16	20.67	142.06	10
15. S. P. S. C. 6102-324-6100	1892	33.5	634	1 3-16	20.67	149.92	4
16. Delfos 6102-2323	1937	34.3	664	1 3-16	20.67	156.35	2
17. S. P. S. C. 6102-550	1926	35.9	691	1 5-32	20.04	157.01	1
18. Delfos 6102-625	1906	34.1	650	1 5-32	20.04	149.10	5
19. S. P. S. C. 631-633	1851	34.5	639	1 3-16	20.67	150.26	3
20. Delfos 910	1842	33.5	617	1 3-16	20.67	145.91	7
21. Express 17	1740	34.0	592	1 3-16	20.67	139.59	11
22. *Wilson's Better Staple	1536	38.0	584	1	18.17	120.39	17

This test was conducted on a cut adjoining the one on which the variety test was conducted. Conditions were very similar. The lint percentages shown in the above table are about two per cent higher than normal.

* In but one plat.

¯ Varieties 8 and 9 were accidentally mixed in harvesting.

TABLE XVIII
COOPERATIVE COTTON VARIETY TEST
Hammond, Tangipahoa Parish, 1929

G. W. Benson, Plantation Owner; Sewell Bahm, Co. Agent; B. Szymoniak,
Hammond Branch Experiment Station and
Louisiana Experiment Station Cooperating.

Variety	Seed Cotton per Acre	% Lint	Lint per Acre	Length of Staple	Value of Staple per lb.	Value of Seed & Lint	Rank in Value
Wann. Cleveland	739.4	36.6	271	7–8	17.17	53.56	3
Marett's Cleveland	630.5	36.0	227	15–16	17.47	45.71	16
Wilson Cleveland	831.1	34.0	283	7–8	17.17	56.81	2
Cleveland-54	705.0	34.5	243	29-32	17.32	49.02	8
Half & Half	538.8	43.2	233	13–16	16.67	43.43	18
Dixie-Triumph	673.5	34.1	230	15–16	17.47	46.83	12
Mebane-Triumph	507.3	37.7	191	1	18.17	39.45	20
Rowden-40	753.8	33.1	250	1	18.17	52.98	4
Acala-37	599.0	35.9	215	1	18.17	44.83	17
D. & P. L. No. 4	642.0	34.6	222	1	18.17	46.64	14
D. & P. L. No. 4-8	596.1	38.4	229	1	18.17	47.12	11
Stoneville No. 2	644.9	33.7	217	1 1-16	18.92	47.47	10
Delfos-911	653.4	31.6	206	1 5-32	20.04	47.99	9
Delfos-6102-A2C3	690.7	31.9	220	1 1-8	19.42	49.78	7
Missdel No. 2	604.7	33.5	203	1 5-32	20.04	46.71	13
Missdel No. 1	567.5	33.1	188	1 5-32	20.04	43.37	19
Delfos No. 2	736.6	31.8	234	1 1-8	19.42	52.98	5
Express-317	773.8	33.5	259	1 5-32	20.04	59.63	1
D. & P. L. No. 6	664.9	33.5	223	1 3-16	20.67	52.72	6
Wilds No. 2	599.0	31.0	186	1 7-32	21.67	46.50	15

COTTON VARIETY STUDIES AT HAMMOND, 1929

The Hammond cotton variety test was conducted about two miles east of Hammond in Tangipahoa Parish. The land used is classed as Pheba fine sandy loam, but is better known, probably, as longleaf pine flats. The land in this area is flat, poorly drained, and not very fertile. These tests were made to see what cotton would do on this type of soil if given fair culture, and further, to see what varieties were best for this region.

No fertilizer was applied to the variety test. Yields could probably have been doubled with a liberal application of fertilizer. In the fertilizer test in the same field where fertilizers were used, good yields were secured.

The cotton was planted April 18, and a fair stand obtained. Plants were rather small at maturity and only moderately well fruited. The cotton was not poisoned and boll weevils did considerable damage. There was some wilt and rust damage.

The yields are low but this is to be expected on soil of this type if the cotton is grown without fertilizers. Of the six ranking varieties three are short staple and three long staple. All are rather vigorous growing varieties. It would not be wise to make any definite recommendations on the basis of one year's test. We are inclined to think, however, that the variety chosen should be moderately prolific, vigorous and early. The ranking varieties in the test all meet these requirements fairly well.

TABLE XIX
RANK OF COTTON VARIETIES IN 1929 TESTS

Variety	Bluff Land Baton Rouge	Alluv. Land Baton Rouge	Prairie Land Crowley	Alluv. Land Race-land	Pine Hills De Ridder	Red R. Valley Mel-rose	Red R. Valley Dixie	Red R. Valley Natch-itoches	N. La. Hill Land Homer	N. La. Hill Land Cal-houn	Oua-chita Valley Mon-roe	NE. La. Delta Land St. Joseph	Pine Flats Ham-mond	Av. Rank
Wann. Cleveland	15	20	7	19	18	18	12	14	14	19	14	20	3	14.8
Marett's Cleveland	19	17	11	..	20	12	16	10	18	18	..	..	16	15.7
Wilson Cleveland	14	5	3	15	8	5	1	1	11	6	7	11	2	6.8
Cleveland-54	13	11	9	..	19	13	..	15	..	15	8	..	8	12.3
Half & Half	21	4	8	12	16	16	11	8	10	10	18	21	18	13.3
Dixie-Triumph	1	1	6	10	5	7	6	5	8	11	5	9	12	6.6
Mebane Triumph	18	14	17	20	12	20	21	21	20	21	20	19	20	18.7
Rowden-40	4	8	20	14	1	14	13	13	12	14	4	10	4	10.0
Acala-37	10	18	15	16	10	15	10	18	9	13	15	16	17	14.0
D. & P. L. No. 4	7	22	14	17	13	17	15	11	19	16	9	17	14	14.7
D. & P. L. No. 4-8	5	19	2	13	15	8	8	7	2	2	10	4	11	8.2
Stoneville No. 2	6	16	4	8	11	10	5	6	13	4	6	14	10	8.7
Delfos-911	8	..	10	9	9	6	..	4	..	3	..	3	9	6.8
Delfos-6102-A2C3	11	2	5	2	6	4	2	2	5	12	17	5	7	6.1
Missdel No. 2	12	3	12	6	7	2	9	16	7	7	19	8	13	9.3
Missdel No. 1	17	6	16	7	14	9	17	17	3	17	11	6	19	12.2
Delfos No. 2	9	7	13	1	2	3	4	12	4	1	..	2	5	5.2
Express-317	2	12	1	3	3	1	3	9	1	9	1	1	1	3.6
D. & P. L. No. 6	3	15	19	4	17	11	..	3	15	5	3	7	6	9.0
Wilds No. 2	16	21	18	18	4	19	14	20	17	20	12	18	15	16.3
Deltatype No. 8	20	..	..	..	..	..	..	..	..	..	..	..	..	..
Stoneville No. 1	..	10	11	..	..	..	..	..	..	..	..	..	..	..
Lone Star X Express	..	9	5	..	..	..	..	..	..	..	..	..	..	..
Delfos-625	..	13	..	..	..	..	..	..	..	..	..	..	..	..
Lankart	..	..	..	..	..	..	20	..	..	..	16	12	..	..
Wacona	..	..	..	..	..	..	19	..	..	..	..	13	..	..
Delfos-463	..	..	..	..	..	..	7	..	..	..	13	..	..	..
Greer-Witchita	..	..	..	..	..	..	18	19	..	..	..	15	..	..
Super Seven	..	..	..	..	..	..	..	..	16	..	..	..	..	..

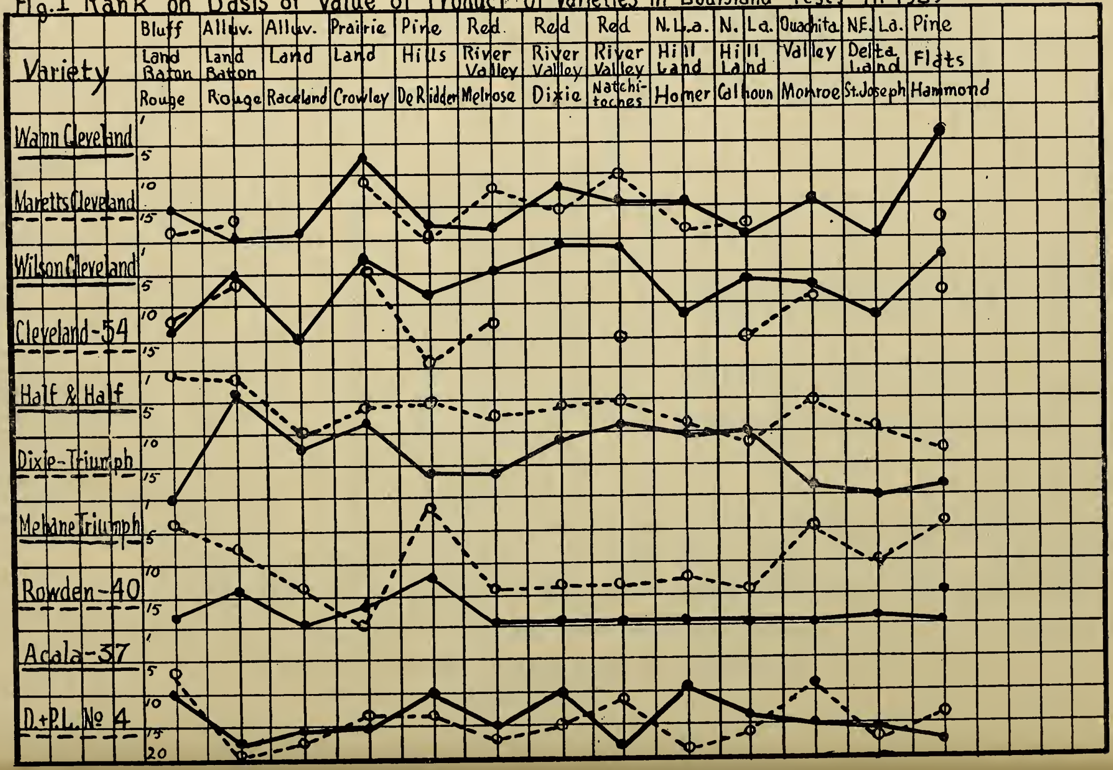
Fig. I Rank on Basis of Value of Product of Varieties in Louisiana Tests in 1929

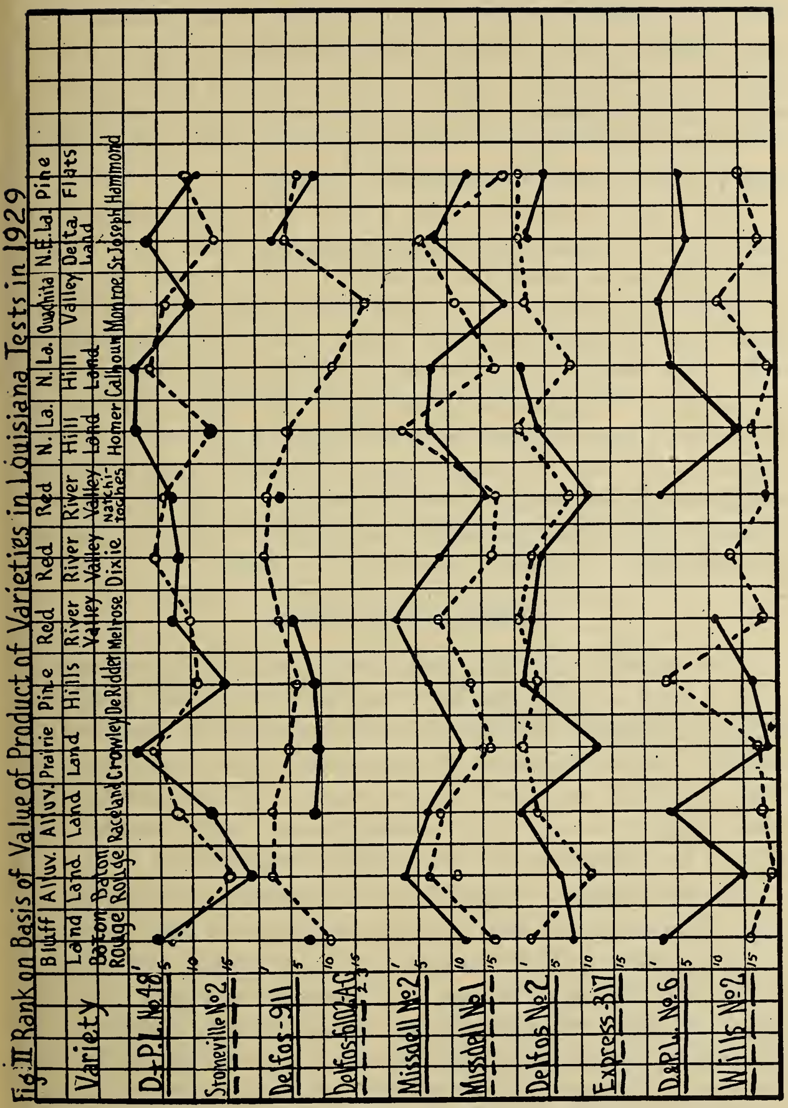

Fig. III Rank on Basis of Value of Product of Varieties in Louisiana Tests in 1929

Table XIX shows the comparative ranking of all the varieties used in the tests in the State the past season. On account of varying conditions, it is not to be expected that one variety will rank high in all parts of the State, yet there seem to be some rather wide adaptations shown. Some varieties, such as Express-317, and a few others rank high in a large part of the tests. Some other varieties have a very low rank quite generally.

The graphs in figures 1 and 2 show at a glance the relative standing of varieties in tests in various parts of the State. If the dot indicating the position of a variety in a test is near the top of the space, that means that the variety has done well in that particular test. If the dot is low in the space, the variety has not done well. The ranking runs from one to twenty. The exact position of a dot in a test is without great significance because adverse conditions may have affected the performance of the variety in that particular test, but the general trend of the line running through a large number of tests does mean something. A variety that consistently stands above the middle of the space is above the average in value and is evidently a good variety to plant.

HOME GROWN SEED

Most experimental tests have shown that home grown cotton seed, if from varieties that have been well bred, makes more productive plants than seed brought in from a distance. Many cotton growers have noticed that they get better yields from imported seed the second year they grow the variety. In one case that has been brought to the writer's attention the negro tenants had noticed the difference and were asking for second year seed.

In the Statewide variety tests in Louisiana the past season home grown seed of four varieties were used in tests including twenty varieties. The four local varieties ranked first, second, fourth, and eighth. This was well above average rank. Similar data have been obtained every year tests have been conducted. It is possible that a part of the difference in rank was due to the breeding or inherent qualities of the varieties but we are inclined to think that it was not all due to that.

Seed from certain areas in nearby States where conditions are similar to local conditions may be satisfactory, but seed of varieties adapted to very different regions, as are found in parts of Texas for instance, are not likely to prove satisfactory.

It is rather unfortunate that there are no commercial cotton breeders in Louisiana that are doing an extensive business. A movement is on foot, however, to make arrangements with certain responsible growers to increase seed of the best strains that are developed by the Experiment Station. This should help considerably.

POISONING BOLL WEEVILS

Probably most cotton growers in Louisiana are satisfied that it pays to poison boll weevils. They have doubtless often observed that if there are many weevils present the man who poisons thoroughly makes three fourths of a bale per acre or more while the man in the same locality who does not poison has to pick five acres or more to get a bale.

The methods of control worked out by the Boll Weevil Laboratory at Tallulah are well known by county agents and most cotton growers. These methods, if followed closely, are very satisfactory for North Louisiana but they do not apply quite so well in South Louisiana where cotton becomes very rank, where weevils are always very plentiful, and where there are daily showers over much of the period that the cotton is fruiting.

In our weevil control work here at Baton Rouge we have made some changes in the regular method of weevil control. We have found it advisable:

1st. To plant only medium early.

2nd. To plant all the cotton near the same time.

3rd. To give the cotton a thorough pre-square poisoning.

4th. To watch the cotton closely for adult weevils and for weevil pupae that are about to hatch out. The adult weevils may be seen in the cotton blooms during the middle of the day. If there are many adult weevils in the cotton blooms, or many pupae which will hatch soon, extra effort is made to keep a liberal supply of poison on the cotton plants.

5th. To apply ten pounds of calcium arsenate dust at each application after the plants become large. We have secured much better control by using the heavier application of poison. With large plants much more poison is needed to give the leaves a coating of dust particles that is equivalent per unit area to the coating they receive when small. It is probable, too, that with a heavier application more poison remains on the plants after a light rain.

If a cart-type cotton duster is used, which is a very satisfactory type for the grower with moderate acreage, an application of ten pounds per acre will cost about one dollar per acre for each application of poison. From four to eight applications will be needed to hold the weevils in check. This seems to be rather costly but will be well repaid in the additional crop made. Growing cotton in South Louisiana is a losing venture unless a fair degree of weevil control is secured.

FUNGOUS DISEASES OF COTTON PLANTS

Cotton plants grown in South Louisiana are subject to several different diseases that are caused by fungi. The most important of these are damping off diseases which kill young plants about the time they emerge from the ground; cotton wilt or black root which usually injures or destroys plants after they reach the blooming stage and boll rots which destroy bolls as they approach maturity.

The only practical method of controlling the damping off disease is to delay planting until the land is warm enough for the plants to germinate quickly and grow off rapidly. With seasonable weather, the plants outgrow the diseases and are bothered but little.

Cotton wilt may be avoided by planting a wilt resistant variety. Dixie-Triumph and Dixie-14 are probably the best wilt resistant varieties for planting in Louisiana.

It is a difficult matter to control the boll rot diseases. We have observed, however, that they are less troublesome on cotton that is planted moderately late, and on cotton that is not rank in its growth. There seems to be some relation, too, as was brought out in Table IV, between wilt resistance and boll rot resistance. Varieties most susceptible to wilt are also somewhat more susceptible to boll rot it appears.

PROMINENT VARIETIES

A brief description is given of the following compartively new varieties which have shown merit in our tests. Characteristics such as lint length, percentage, etc., given in the tables are not repeated here.

Wilson Cleveland—This variety was developed by M. W. H. Collins in Northern Georgia, but transferred to Wilson, Arkansas, in 1925, and increased. The name Collins' Cleveland has been used for the variety in some of our reports. The plants of this variety are medium sized, usually compact, rather early and prolific. The staple is rather short and irregular and the compactness is probably a disadvantage in that with this type of plant more trash is gathered with the cotton in picking.

Dixie-Triumph—This variety which is considered to be a hybrid between Mebane Triumph and Dixie originated in South Carolina a few years ago. It resembles the Dixie parent. Plants are rather large and growthy, very resistant to wilt and apparently somewhat more resistant to other diseases than are several other varieties. It is only medium early and prolific but yields well.

Rowden-40—This is a selection from Texas Rowden made by J. O. Ware of the Arkansas Experiment Station. It appears to be a hybrid between Rowden and some other smaller bolled more prolific variety. Plants are rather large and vigorous and fairly productive.

D. & P. L. No. 4-8—This is a selection from D. & P. L. No. 4 made by E. C. Ewing, cotton breeder for the Delta and Pine Land Co., of Scott, Mississippi. This variety is similar to D. & P. L. No. 4 in general characteristics but has slightly shorter staple and considerably better lint percentage. It is medium in prolificacy and wilt resistance.

Missdel No. 2—This is a selection from Delfos-6102 and was known for some years as Delfos-1341. The selection was made by the cotton breeder at the Delta Branch Experiment Station, Stoneville, Mississippi. Plants are small, early, and prolific. The lint percentage is higher than in most other strains of Delfos.

Express-317—This variety and the three following were originated by the writer at Stoneville, Mississippi, when he was plant breeder for the Stoneville Pedigreed Seed Co. Express-317 was developed from a plant selection made in a field of Express-432. Plants are medium large, vigorous and fairly wilt resistant; foliage is moderately light and the variety early and prolific.

Delfos No. 2 was selected from Delfos-631, and differs from the parent strain in having smaller bolls, smaller leaves, and more vigorous and more prolific plants.

Delfos-6102-2323 was selected in a field of Delfos-6102 and has many of the characteristics of the original strain, being early and very prolific. The staple length is a little above the average of Delfos strains.

Stoneville No. 2—The original plant of Stoneville No. 2 was selected in a field of Lone Star-65. Plants are medium sized, rather early and prolific, and medium wilt resistant. In general characteristics, this variety resembles Delfos but is slightly taller, more wilt resistant, and has a better lint percentage.

SUMMARY

1. Cotton is the most important crop grown in Louisiana. Its value in 1929 approximated $75,000,000.

2. Louisiana ranks third among the states of the Cotton Belt in the production of long staple cotton and eighth or ninth in total production of cotton.

3. Although there are some inferior varieties still grown in Louisiana, there is a marked trend toward the introduction of better varieties.

4. Planting a well adapted variety is the easiest way to increase yield per acre.

5. Seed grown in Louisiana will probably produce better yielding plants than seed grown in other states. Four of the twenty varieties planted in the Louisiana tests in 1929 were from home grown seed. These varieties ranked first, second, fourth and eighth. This was well above the average. Similar results have been obtained in other years.

6. Over much of Louisiana during most seasons, it is impossible to grow a good crop of cotton without poisoning boll weevils.

7. Tests during the past three years have indicated that Wilson Cleveland, D. & P. L. No. 4-8, Dixie-Triumph, Stoneville No. 2, Delfos, D. & P. L. No. 6, and Express 317 are generally the

most paying cottons to plant. The adaptation to particular regions may be learned by study of regional test reports.

SOURCE OF SEED

Coker Pedigreed Seed Co., Hartsville, S. C.—Cleveland-5-2, Cleveland-884, Deltatype-7, Foster-4, Lightning Express-7, Super Seven-5, Wilds No. 2.

Delta and Pine Land Co., Scott, Miss.—D. & P. L. No. 4-8, D. & P. L. No. 6, D. & P. L. No. 4128A-21-32, D. & P. L. No. 5242A-310-47.

Delta Experiment Station, Stoneville, Miss.—Delfos-6102-2103, Delfos-910.

Robert Dortch, Scott, Ark.—Rowden-40.

Will Dockery, Dockery, Miss.—Delfos-911.

Experiment Station, Marianna, Ark.—Rowden-2119, Rowden-3054, Rowden-2088, Express-17.

R. L. Fulcher, Louisville, Miss.—Cleveland-54.

Greer Staple Cotton Breeding Farms, Iowa Park, Texas—Greer-Witchita.

Lankart Bred Seed Farms, Waco, Texas—Lankart, Wacona.

Louisiana Experiment Station, Baton Rouge, La.—Dixie-Triumph, Delfos No. 2, Delfos-6102-2323, Delfos-6102-625, Express-317, Lone Star X Express, Stoneville No. 1.

Marett Farm & Seed Co., Westminster, S. C.—Marett's Cleveland-7, Marett's Cleveland-6B, Marett's Cleveland-5.

Mrs. A. D. Mebane, Lockhart, Texas—Mebane Triumph.

North La. Experiment Station, Calhoun, La.—D. & P. L. No. 4.

Loy E. Rast, Newport, Ark.—Acala-37.

J. O. M. Smith, Commerce, Ga.—Piedmont, Cleveland.

Stoneville Pedigreed Seed Co., Stoneville, Miss.—Delfos-6102-A_2C_3, Cook-1010-519, Stoneville No. 2, Stoneville-690, Stoneville No. 3, 631-633, 6102 x 65-632, 6102-324-6207, 6102-324-6106, 6102-324-6100.

Mrs. W. H. Stovall, Stovall, Miss.—Missdel No. 1, Missdel No. 2.

B. F. Summerour, Norcross, Ga.—Half and Half.

Wannamaker-Cleveland Seed Co., St. Matthews, S. C.—Wannamaker-Cleveland, Wannamaker Staple Cleveland.

Lee Wilson & Co., Wilson, Ark.—Wilson Cleveland.

D. W. Wilson, Duluth, Ga.—Wilson Staple.

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THE AGRICULTURAL CREDIT SITUATION IN LOUISIANA

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AGRICULTURAL CREDIT SITUATION IN LOUISIANA

INTRODUCTION

Rural credits attained an interest of national importance in the United States during the first decade of the twentieth century. Since that time national commissions and individuals from the various departments at Washington have been studying and investigating the practices of credit agencies as well as the credit needs of the farmers, for the purpose of bringing together sufficient information to give to the various law-making bodies a basis for remedial legislation. As a result of the findings of these investigators, several important bills have been enacted both by Congress and state legislatures, that provide for institutions, which will more adequately meet the credit needs of agriculture. Among the important national institutions that have been established are: the Federal Reserve Banks; the Federal Farm Loan Banks; and the Intermediate Credit Banks. Rural credit unions and rural credit systems are institutions that have been provided for through state legislation.

Except in a very general way, Louisiana's rural credit problem has not been given much attention by the agricultural leaders of the State. A recent study has been made by Professor Morehead of Centenary College, Shreveport, Louisiana, on Merchant Credit to Louisiana Farmers. This is the only credit study that has been published in the State.

There has been a growing demand for information concerning the credit situation in Louisiana for the past few years, and this demand, together with the general interest in the problem has led to this study.

PURPOSE OF STUDY

The main objectives of this investigation have been to discover: (1) the factors affecting the agricultural credit needs of the State; (2) to what extent these needs are met; (3) agencies supplying credit to Louisiana farmers; (4) the conditions of credit as to term, costs, uses and security required; (5) recent changes that have taken place with respect to agricultural credit; and (6) methods and proper procedure for further study of the problems of rural credits in Louisiana.

SCOPE

The scope of this study is limited to agricultural production credit in Louisiana, including short-term, intermediate and long-term credits. The owner-operators of large cotton plantations in the Red River bottoms, and the cropper tenants are excluded from the study.* There is no effort to analyze the financial structure of lending institutions nor their general organization, except as these directly affect the extension of credit to farmers. Consumption credit is considered only where it is impossible to separate it from production credit.

SOURCES OF DATA

The principal sources of data for this study are: (1) a survey made in Louisiana during the fall of 1928 and the spring of 1929; (2) the reports issued by the Census Bureau, the Federal Farm Loan Board, the bank commissioner of Louisiana, and the Comptroller of the Currency; and (3) the United States Department of Agriculture Year Books.

PROCEDURE

The State was divided into four areas according to the acreage planted to the principal cash crops. This was based on the information given in the Census of Agriculture, 1925. In 41 parishes, cotton ranked first, sugar cane ranked first in 13 parishes, rice in six, and fruit and vegetables in 4. Corn occupies a large acreage in most of the parishes but it is not a cash crop and is not considered here. Corn is grown primarily for feed on the local farms. Figure 1 shows what parishes fall into these different districts.† These districts are designated hereafter as the cotton area, the rice area, the sugar cane area, and the fruit and vegetable area.

The crop year for cotton, cane and rice coincides with the calendar year, but for the fruit and vegetable area, it is from July to July. In order to get information from the fruit and vegetable growers, for the 1928 crop, it was necessary to make schedules that called for information from July 1st, 1927 to July 1st, 1928. This period, though it is six months ahead of the period considered for the other areas, is representative of the activities of these farmers in producing the 1928 crop. All other farm schedules were prepared to fit the calendar year, 1928.

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*The financing problems on the plantation are different from those on other farms in the State. As a rule, the plantation is divided into twenty and thirty acre plats and these are operated by cropper tenants or by day laborers. The laborers and croppers are given credit through the plantation store which is often operated by the owner of the plantation. To deal with the cotton plantation would involve a study of a financing institution rather than the credit on a particular farm. This is a problem within itself and should be studied as such. The cropper is excluded because he is, as a rule, in the same relation to the landlord as a hired hand. The landlord furnishes all capital necessary to carry on the farm business and in most cases advances food and clothing throughout the year until the crop is harvested. Thus the cropper gets half the proceeds from the sale of the crops for his labors, and does not assume the responsibilities of financing the business.

†A parish is similar to the county unit in other states.

In addition, there was obtained from the following agencies information on agricultural credit for the year 1928: merchants, local banks, Federal Land Bank, the Intermediate Credit Bank, insurance companies, farm associations,‡ National Farm Loan associations, and land companies.

The field survey method was used to get information from farmers, merchants, farm associations and some local banks. Other local banks, and the remainder of the agencies were sent questionnaires through the mails. Schedules were taken at random from farmers, farm associations and merchants. A complete enumeration was attempted for the other agencies. The results of the two methods of obtaining data were satisfactory except for the local banks and merchants. In order to get better cooperation from these agencies, the schedules used would have to be abbreviated to the extent that their value would have been lost.

The number of usable records obtained from the different sources are: from farmers, 809; merchants, 38; banks, 26; national farm loan association, 46; local farm associations, 12; land companies, 4; and insurance companies, 11; (153 schedules were returned by insurance companies but only 11 held mortgages on Louisiana farms). Personal visits were made to different parts of the State and much additional information was obtained from leaders in different lines of work.

The information obtained from the agencies has been analyzed and the results are found in the succeeding pages of this bulletin.

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‡"Farm Association" is a name given to particular types of financing institutions that have developed in the strawberry area of Louisiana. The form of organization varies from a simple private business to a more complex type of corporation. Most of these organizations are agricultural supply companies. These institutions advance cash and supplies to farmers on the basis of crop lien notes or chattel mortgages as security. The local term "Farm Association" is used in this discussion to designate this group of institutions.

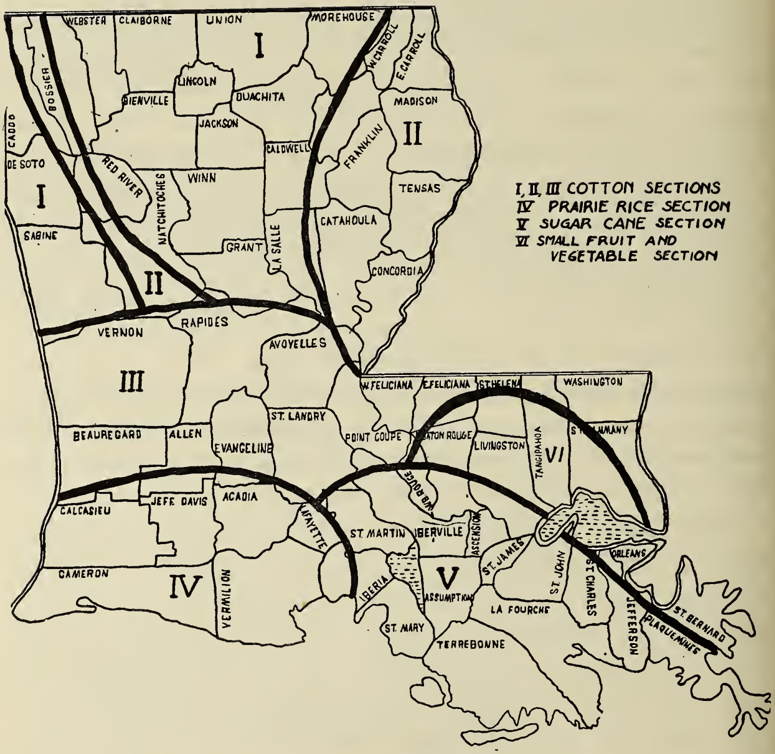

Fig. 1. Farming Areas in Louisiana.

SECTION I.

CREDIT INSTITUTIONS IN LOUISIANA AND THEIR RELATION TO AGRICULTURE

Louisiana's financial institutions are the products of the evolutionary processes that have been going on in this country since early Colonial times. At present, the State is supplied with a variety of financial agencies the most of which are directly or indirectly tied up with the agricultural program of the region. A discussion of the most important of these include: commercial banks; retail merchants; farm associations; the Intermediate Credit Bank; the Federal Land Bank; and insurance companies.

COMMERCIAL BANKS

At the beginning of 1928, there were 231 commercial banks operating in Louisiana, with total resources amounting to more than 526 millions of dollars. Thirty-one of these banks were national and two hundred were state banks. Tables I and II indicate the relative importance of these two classes of banks with respect to total resources, total loans and discounts, and total deposits from 1914 to 1928.

It has not been possible to obtain these data for the same dates. The national bank reports are made on call and the date of call varies from year to year. An effort was made to select dates as near as possible for the same season of the year—the fall months. For purposes of detecting relative changes that have taken place in deposits, resources, and loans and discounts, the data for the two classes of banks have been combined, reduced to 1913 dollars and plotted, (Fig. 2). It will be noted that total resources declined from 191 millions of dollars in 1914 to 119 millions in 1918, moved upward to 333 millions in 1924 then dropped back to 285 millions in the fall of 1925. The movement has been upward since 1925 and reached a peak of 363 millions at the end of 1927. Total deposits show an increase through-out the period, falling slightly in 1918 and 1920 from the preceding years. Starting with 125 millions of dollars of purchasing power in 1914, bank deposits moved up to over 302 millions by 1928. Total loans and discounts

TABLE I

COMMERCIAL BANKS OTHER THAN NATIONAL BANKS REPORTING IN LOUISIANA FROM 1914 TO 1928, AS OF DEC. 31*

(In 1000 Dollars)

Year	No. Banks	Total Resources	Total Deposits	Total Loans and Discounts
1914	214	$119,512	$ 92,418	$ 82,344
1915	210	127,160	101,124	80,798
1916	209	127,741	129,650	87,254
1917	211	124,500	197,131	111,970
1918	221	126,110	198,514	140,547
1919	221	131,103	312,157	202,111
1920	237	159,976	269,577	250,976
1921	231	130,824	251,924	213,408
1922	230	162,493	304,939	218,431
1923	227	380,502	330,637	240,607
1924	216	377,923	341,720	248,472
1925	214	332,243	372,421	270,181
1926	201	364,863	346,999	263,238
1927	200	402,808	358,120	253,847

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*Reports of the Louisiana Bank Commissioner, 1921 to 1927.

TABLE II

NATIONAL BANKS IN LOUISIANA, 1914 TO 1928*

(AS OF FALL MONTHS)

(In 1000 Dollars)

Year	No. Banks	Total Resources	Total Deposits	Total Loans and Discounts
1914	32	$ 67,801	$ 30,350	$ 34,856
1915	31	66,710	30,812	34,233
1916	32	77,797	42,658	44,080
1917	33	96,606	58,371	52,294
1918	31	105,383	62,418	66,397
1919	32	120,483	76,142	72,667
1920	38	156,802	88,781	105,261
1921	37	100,000	73,783	74,041
1922	34	118,382	73,443	70,040
1923	34	133,706	55,839	48,945
1924	34	119,596	91,664	73,703
1925	33	118,900	79,147	74,684
1926	32	143,261	89,491	91,075
1927	31	123,582	80,470	78,559

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*Reports of the Comptroller of the Currency, 1914 to 1928.

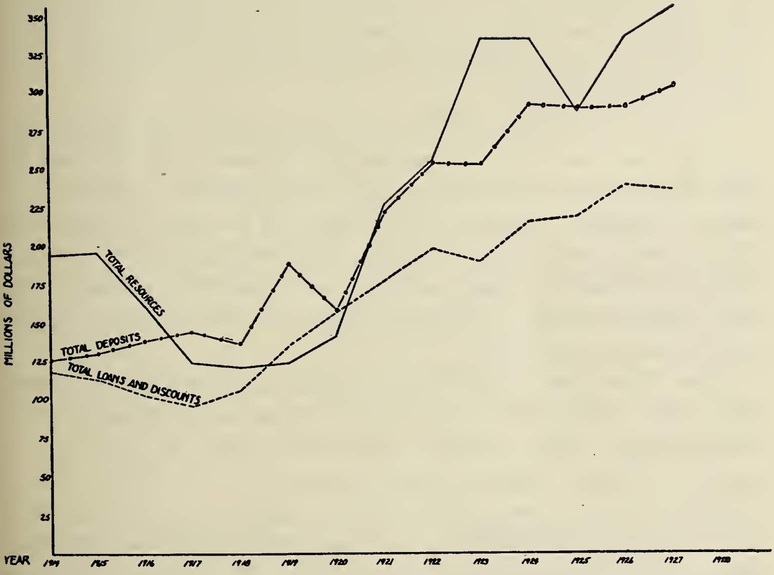

Fig. 2 Curves Showing Absolute Changes in Total Resources, Total Deposits, and Total Loans and Discounts for Commercial Banks in Louisiana from 1914 to 1928. (Reduced to 1913 Dollars by the use of the Bureau of Labor Statistics Index.)

moved somewhat in line with the other two items declining from 119 millions in 1914 to the low level of approximately 92 millions in 1917 and then increased to more than 229 millions by 1928. This indicates that the State controls through its banks a larger volume of purchasing power and the loans and discounts are mounting higher the further we are removed from the so called prosperous period of 1917 to 1920. Agriculture is demanding a large part of this as is shown below.

It was estimated that the Commercial banks of Louisiana held 63 per cent of the total farm mortgages of the State in 1920,[†] and the amount of personal and collateral loans outstanding to farmers in December, 1920, represented 21.37 per cent of the bank's total loans and discounts.[‡]

In 1923, sixteen state banks were members of the Federal Reserve System, in 1925, the number had decreased to 12, and by 1927 there were 10 state banks that were members of the Federal Reserve System. However, a large part of the State's total bank resources was under the supervision of the Federal Reserve System. In 1923, the member banks resources constituted 72 per cent of the total bank resources of the State, 83 per cent in 1925, and 72 per cent by the end of 1927.

Since 1900, there have been fifty-seven bank failures among state banks in Louisiana and forty of these failed prior to 1923. Twenty-nine of these occurred during four years, divided into two periods as follows: thirteen failed during 1913 and 1914—"due to conditions which resulted from the ravages of the cotton boll-weevil;" sixteen failed during 1921 and 1922, which was an aftermath of the deflation period during 1920. The remaining failures did not occur during any particular period.[*] The 17 banks failing after 1922 represented about 1¾ per cent of the total capital and declared surplus of all state banks; deposits involved, represented seven-tenths of one per cent of the total deposits of state banks; and the losses to depositors will be less than one-half of one per cent of total state bank deposits when the business of these banks is finally closed.[§]

[†] Valgren, V. N., and Engelbert, E. E.—Farm Mortgage Loans by Banks, Insurance Companies and other Agencies. U. S. D. A. Bul. 1047, 1921, p. 3.

[‡] Valgren, V. N., and Engelbert, E. E.—Bank Loans to Farmers on Personal and Collateral Security. U. S. D. A. Bul. 1048, 1922, p. 3.

[*] Sixteenth Biennial Report of the Louisiana Banking Department, 1924-1925, p. xi.

[§] Seventeenth Biennial Report of the State Banking Department of Louisiana 1926-1927, p. ixxvii.

Louisiana banking laws have changed from time to time which tends to strengthen commercial banks in the State. Prior to 1916, banking associations could obtain a charter with a minimum of $10,000 capital stock, if the bank were situated in a town of less than three thousand population. In 1916 this act was amended to limit the minimum capital stock to $15,000 and in 1924 this minimum was raised to $25,000. Any state banking association organized under present banking laws falls in one of three classes. If the bank is located in a city of 30,000 population or more capital stock must be $100,000, if in a city or town with a population from 3,000 to 30,000 the capital stock must be $50,000, and if in a small town of 3,000 population or less the capital stock must be $25,000.‡ The size of the banks that failed during the twenty-seven years is shown in Table III.

Table III indicates that there is a close relationship between the size of banks and the number of failures, as over 50 per cent of the banks that failed had a capital stock of less than $25,000. Small banks usually have a limited volume of business which results in relatively low earnings. This condition makes it impossible in most cases to employ bank officials that are capable of managing the business in the most efficient manner. Poor management and small volume of business place the small bank in a

TABLE III

PERCENTAGE DISTRIBUTION OF COMMERCIAL BANKS IN LOUISIANA ON THE BASIS OF CAPITAL STOCK PAID IN AND THE PERCENTAGE DISTRIBUTION OF BANK FAILURES ON THE BASIS OF CAPITAL STOCK, 1900-1928‡

Capital Stock	Per Cent of Total Banks in Operation*	Per Cent of Banks that Failed to Total Failures§
10,000 to 25,000	28	54
25,000 to 50,000	25	26
50,000 to 75,000	22	7
75,000 to 1,000,000	5	11
1,000,000 and over	20	2

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‡Supplement to Laws of the State of Louisiana Relating to Banks and Trust Companies, 1927, p. 5.

*Based on arithmetic average of banks in the State from 1922-1928.

hazardous position. The State Bank Commissioner states that approximately 90 per cent of bank failures can be traced to inefficiency on the part of bank management.[†]

Eight national banks have failed in Louisiana since the introduction of the national banking system. Six of these failures occurred prior to 1925.

The causes of bank failures are many. The report of the Comptroller of the Currency gives the following causes for failure of national banks:[¶]

1.	Incompetent management	24 per cent
2.	Dishonesty	6 per cent
3.	Local financial depression from unforseen agricultural or industrial disaster	57 per cent
4.	Combination of causes, 1 and 2	10 per cent
5.	Combination of causes, 1 and 3	2 per cent
6.	Formerly in voluntary liquidation	.5 per cent
7.	Not reported	.5 per cent

Relatively few banks in Louisiana have failed due to agricultural causes. According to the State Bank Commissioner, the causes for bank failure in the State since 1920 are: agricultural condition, 16 per cent; dishonesty, 47 per cent; lack of confidence, 5 per cent; mismanagement, 21 per cent; and insufficient volume of business and bad loans, 11 per cent.

On January first, 1928, there were 231 banks operating in the State. The estimated population was 1,943,000.[*] This is one bank for every 8,411 people. The per capita bank resources for the State are 271 dollars, the per capita deposits are 226 dollars, and the per capita bank loans and discounts for the State are 171 dollars. The more recent activities of commercial banks in supplying agricultural credits to Louisiana farmers are discussed in a later section.

RETAIL MERCHANTS

Another source of credit for farmers in Louisiana is the retail merchant. However, the data on merchant credit are very inadequate. The State is dotted throughout with villages, towns and a few large cities. There are 323 such centers with a population ranging from 200, in the smallest village included in this count, to over 400,000 in the largest city. In these centers are to be found many types of businesses, which tend to become more and more specialized as the center grows larger. Outside of New Orleans, the largest city in the State, there were in 1925, 8,679 retail businesses that carried a line of commodities that commonly enter the farmer's budget. Of the above number, 4,338 were classed as general stores; 3,558, as grocery stores; 437, as dry goods stores; 154, as furniture stores; 132, as hardware stores; 52, as feed and fertilizer businesses; and 8, as farm implements and machinery establishments.† These stores range in size from the little grocery at the cross-roads to the large establishments in the city.

[†] Sixteenth Biennial Report of the Banking Department, State of Louisiana, 1924-1925, p. xvii.

[‡] Fifteenth, Sixteenth and Seventeenth Biennial Report of the State Banking Department of Louisiana, 1922-1927.

[§] Seventeenth Biennial Report of the State Banking Department of Louisiana, 1926-1927, p. lxxvii.

[¶] Report of the Comptroller of the Currency, 1927, pp. 236-248.

[*] Year Book, United States Department of Agriculture, 1928, p. 180.

If the total population, exclusive of New Orleans, be divided by the number of establishments, it will be found that the population per general store was 344 in 1925; for grocery stores, 419; for dry goods stores, 3,414; for furniture stores, 9,688; for hardware stores, 11,303; for feed and fertilizer establishments, 28,692; and for farm implements retailers, 186,500. If only farm population is to be considered, the distribution is as follows: general stores, 160; grocery stores, 195; dry goods stores, 1,593; furniture stores, 4,521; hardware stores, 5,274; feed and fertilizer stores, 13,388; farm implements stores, 87,022. This does not, by any means, indicate the number of customers for any particular class of business. There is an overlapping of services throughout except for the highly specialized units. The general store carries a line of groceries, hardware, dry goods, feed and many other commodities that are utilized on the farm. The hardware store carries a line of farm machinery in many cases, and sometimes feed is carried as a side line. The purpose of bringing out these statistics is to show that retail merchants abound in sufficient numbers to render a significant service to farmers of the State. These services are given in exchange for cash, in direct exchange of farm produce for merchandise, or for credit. Cash and carry stores are fast replacing the old type grocery stores, and the dry goods merchants are demanding cash rather than credit business. Most merchants in the rice, the sugar cane and the strawberry sections are limiting their credit to thirty day business except for the more durable goods. The cotton area still supports, to a great extent, the old line credit merchant.

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†A count was made from Bradstreets, 1925.

The question arises, What institutions are furnishing the credit that was once furnished by merchants? There are two types of agencies that have developed in recent years that furnish this credit. These are what are locally known as farm associations in the berry section, and the agricultural credit corporations in the cane and rice sections. Farmers are able to get cash advances from these agencies with which to pay bills at the store.

LOCAL FARM ASSOCIATIONS

In the strawberry section of Louisiana, institutions, known as "Farm Associations", have developed. These play an important part in financing farmers who are engaged in the production of strawberries and vegetables. These associations have no definite form of organization. Some are private enterprises, some are partnerships, others are corporations, and still others are cooperative in form. These institutions are all called "farm associations" by the farmers of the area. They are located at shipping centers, some communities being served by several of these agencies. There is keen competition between them in an attempt to get a large volume of business, and this often results in poor business practices on the part of the association management. Any farmer, regardless of economic standing, who desires to enter the truck farming business, can get credit from some one of these associations.

These institutions are financed in different ways. For some, cash is furnished by individuals who have a surplus; for others, the local banks supply the necessary funds; and others are financed by the larger fruit and vegetable selling organizations, fertilizer companies or other concerns which market their farm supplies in this area. The Intermediate Credit Bank in New Orleans rediscounts some agricultural paper where the form of organization meets the requirements. In case of cooperatives, most of them are financed by farmer members who have surplus money that they wish to put out at interest.

These associations do very little open account business. The common type of security used, is the crop lien note with an indorsement. In some cases the associations demand a chattel mortgage on the livestock and equipment in addition to the crop lien.

Advances are made to farmers, either in the form of cash or supplies. Very often it is found that the association supplies the fertilizer, seed, crates, and farm tools, and in addition allows a monthly cash advance with which to pay grocery bills. The amount of credit any one farmer receives during the year depends upon the number of acres in cultivation, the amount of family labor and the farmer's past record. At the beginning of the loan period, which is usually from six to ten months prior to the marketing season, farmers make notes to cover the amount of credit that the association will allow for the year. The farmer therefore knows how much credit is available for the production of the crop. The association is obligated to advance a certain amount on demand, except where the contract calls for a definite distribution over a period of time. The farmer pays interest on the face value of the note for the full period.

There is rather close supervision maintained by the associations over farm operations. Field visits are made periodically by the proper officials of the associations, and if it is found that the farmer is mis-using the loan, or that he is failing in any way to meet the conditions of the contract, the credit allowance is adjusted to the new conditions. All sales of crops are taken care of by the associations until individual debts are paid.

INTERMEDIATE CREDIT BANK OF NEW ORLEANS

This bank was established under the provision of the Intermediate Credit Act of 1923 for the purpose of extending intermediate credit to farmers. In practice, this bank makes its loans for periods of six to nine months, on commodities of various kinds, mainly livestock, rice commodities and strawberry crates. It also makes crop production loans, the funds for which are used to grow current crops; and cattle loans for the purpose of raising cattle. Some loans are made to dairymen. These loans are procured from agricultural credit corporations. Table IV shows the amount of these loans made by the Intermediate Credit Bank since the beginning of its operation in the State.

TABLE IV

CREDIT EXTENDED BY THE INTERMEDIATE CREDIT BANK FOR AGRICULTURAL PURPOSES IN LOUISIANA. 1924 TO 1928*

(In 1000 Dollars)

	1924	1925	1926	1927	1928	Total
Total Production Loans..$	883	$3,149	$2,191	$3,453	$3,832	$13,511
Total Commodity Loans	552	695	2,341	3,086	1,191	7,874
Both Purposes	1,435	3,844	4,532	6,539	5,023	21,385

An inspection of Fig. 3, Page 20, will show the location of the credit corporations of the State that discount paper with the Intermediate Credit Bank.

The Bank in New Orleans could supply a much larger amount of credit to farmers through the proper channels if it were demanded. This fact is verified by a statement from the Secretary of the Intermediate Credit Bank, which is—"Farming interests of the three states‡ have not taken advantage of Federal Intermediate Credit to the extent that we had hoped. We have available about fifty millions of dollars which could be lent, but have been called on to lend perhaps not more than fifteen or eighteen millions in any one year."† The lack of demand for intermediate credit can be explained, in part, by the following: (1) that banks—especially in the cotton section of the State—can finance their customers adequately; (2) the control which various local merchants have over their customers, and from which control the customers are reluctant to withdraw; and (3) the apparent burden of the requirements under which loans could be made by the credit corporations.

Perhaps farmers in the sugar cane area have suffered more since the fall of prices in 1920 than any other group of farmers in Louisiana. In 1920 the crop was produced on the basis of twelve and fourteen dollars per ton for cane and the selling price in the fall of 1920 was four and five dollars. This condition placed the cane farmer in a position that he could not meet his obligations to the banks and other financing institutions that had advanced money with which to produce the cane crop. Cane prices have remained relatively low since 1920 and in addition to this factor, the cane plants have been attacked by cane borers and mosaic disease to the extent that production has fallen below that of former years. With the low yields and low prices for the product, cane farmers had practically exhausted every source of credit open to them by 1924. Commercial banks did not find it advisable to continue financing cane production. Local merchants were reluctant in furnishing farmers of the area with supplies, and farmers were on the verge of bankruptcy throughout the cane area. Agricultural leaders discovered early in the period of depression that several things had to be done if the cane industry were to continue in Louisiana. Among these were: (1) new varieties of cane must be introduced that were prolific and able to resist the borer and Mosaic disease; (2) the apparently worn out soils must be rejuvenated by better cropping practices and heavier applications of fertilizer; (3) some means of financing the farmer through this period of development must be found. The experiment stations, both private and public, worked on cane varieties and developed the substitution of what are known as P. O. J. Canes which proved to be much superior to the old varieties. The Agricultural leaders worked out systems of crop rotation and determined the fertilizer needs of the cane soils. The program of improvement involved cash expenditures on every hand. The new varieties of cane cost money to get them started on the farm, and the growing of legumes and other non-cash crops placed an apparent burden on the farmer, and heavier applications of fertilizer also meant an additional cash outlay. With the old credit agencies out of the field there was no place to look for help until after the Intermediate Credit System was established. As soon as the State Agricultural Credit Corporation was organized and started operations, the cane farmer found a source of credit that would meet at least the minimum cash requirements. This Institution has been taking care of a large portion of the cane farmers' needs for the past few years and with this assistance, the cane industry seems to be getting back to normal. The Intermediate Credit Bank has been responsible to some extent for the cane industry as it is at present. In addition to financing the industry, it has helped to restore confidence and other institutions are ready to advance loans, however, they are still slow to get back into this activity.

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*Data furnished by the Intermediate Credit Bank of New Orleans.

‡Reference is here made to Alabama, Mississippi and Louisiana.

†Quoted from a letter written by the Secretary of the Intermediate Credit Bank of New Orleans, December 18, 1928.

The outstanding value of the Intermediate Credit System, other than advancing money, is in the system of field inspection that is maintained by the credit corporations. These inspectors serve as educational leaders in promoting better farming. They assist those farmers who are ready and willing to accept advice, thereby strengthening their position and at the same time exerting a force that will cause the poorer farmers to improve their practice or get out of the farming business. The quality of agriculture in the different regions is improving due to this work, as viewed by some of Louisiana's agricultural leaders.

LONG-TERM CREDIT AGENCIES

The Federal Land Bank in New Orleans, which serves the Fifth District, is the most important long-term lending agency in Louisiana. This Institution has made, through the national farm loan associations 15,112 loans to farmers amounting to more than thirty-seven millions of dollars. These loans are distributed over every parish in the State. Loans as high as $50.00 per acre have been made on the better lands, while on the poorer lands they amount to but a few dollars per acre. Collections from farmers on the amortization plan have been successful for the most part. There have been a few foreclosures in the hill sections of the State and a greater number in the sugar cane section.

Figure 3 shows the distribution of the national farm loan associations in Louisiana. Some of these associations handle a very small volume of business and it is hard for them to keep a secretary on the job to take care of the business.

The First Joint-Stock Land Bank, a part of the Federal Farm Loan System, also located in New Orleans, has been doing a comparatively small amount of business in Louisiana. The demands for extra large loans are limited and smaller loans are well taken care of by other existing agencies. Table V shows the relative importance of the Land Bank and the Joint-Stock Land Bank over a period from 1918 to 1928.

Agricultural loans from the Federal Land Banks and the Joint-Stock Land Banks have increased steadily in the United States since 1918. There was an interruption in 1920 due to the question of the constitutionality of the Federal Farm Loan Act, but as soon as this question was settled by the courts, business for these institutions expanded very rapidly until 1926. Since this date, the amount of loans has increased at a much slower rate.

The amount of loans to Louisiana farmers from the Federal Land Bank and the Joint-Stock Land Bank has taken about the same movement as those for the United States. The greatest increase in any one year over the preceding year for the United States was 372.3 per cent for 1922. Loans to Louisiana farmers for the same year increased 222.5 per cent.

TABLE V

TOTAL LOANS BY THE FEDERAL LAND BANKS AND THE JOINT-STOCK LAND BANKS TO LOUISIANA FARMERS AND FOR THE UNITED STATES FROM 1918 TO 1928*

(In 1000 Dollars)

	——Louisiana——			——United States——		
Year	Federal Land Bank	Joint-Stock Land Bank	Total	Federal Land Bank	Joint-Stock Land Bank	Total
1918..........	$ 1,799	....	$ 1,799	$ 149,004	$ 8,384	$ 157,388
1919..........	4,472	....	4,472	282,007	60,037	342,045
1920..........	5,871	....	5,871	369,242	77,958	447,201
1921..........	7,280	....	7,280	441,859	85,016	526,876
1922..........	11,824	....	11,824	684,407	218,775	903,182
1923..........	17,750	$ 601	18,352	876,490	392,638	1,269,129
1924..........	26,097	601	26,699	1,042,001	446,429	1,488,430
1925..........	31,677	934	32,611	1,169,356	545,559	1,714,915
1926..........	33,799	1,073	34,872	1,300,674	632,475	1,933,149
1927..........	36,558	1,374	37,933	1,441,058	669,798	2,110,856
1928..........	37,540	1,429	38,969	1,541,434	656,516	2,197,951

The greatest percentage decrease in the United States and Louisiana was during 1928, being 51 and 66 per cent respectively, below the loans for the preceding year. Perhaps the explanation for this relative decrease in amount of loans is because farm transfers were not being made to any great extent, and too, there is possibly less borrowing for the purpose of paying mortgages and other debts.

INSURANCE COMPANIES

Insurance companies have played an important part in agricultural credits during the past three decades. There are 256 insurance companies operating in the State of Louisiana, and of this number fifty-six are life insurance companies. Due to the fact that small numbers of these companies have their home offices in Louisiana, few loans are made on farm mortgages. According to

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*Reports of the Federal Farm Loan Board, 1918 to 1928.

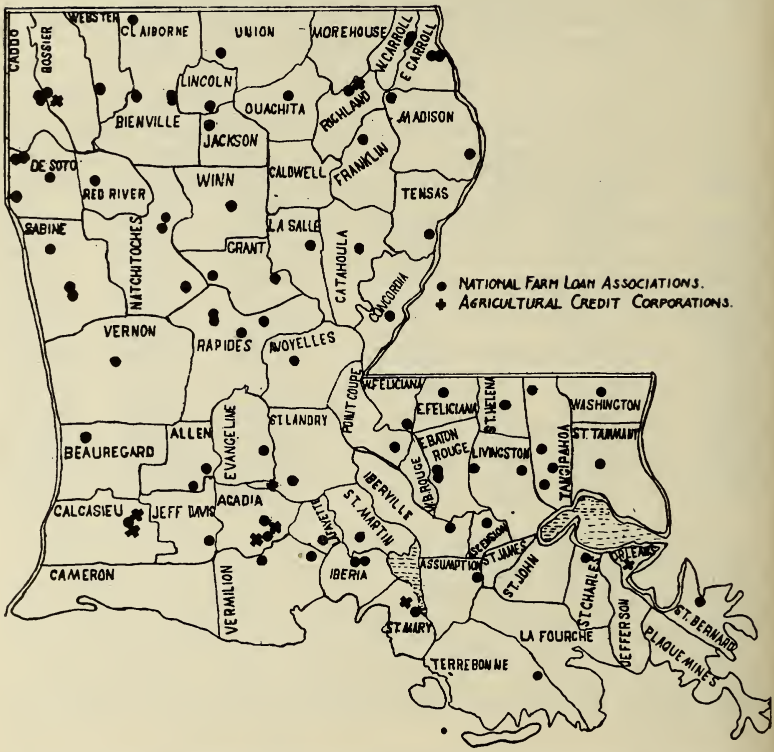

Fig. 3. Location of National Farm Loan Associations and Agricultural Credit Corporations in Louisiana in 1928.

reports of some of these companies they prefer to make their loans in localities where they can be closely supervised. The importance of life insurance companies in the systems of farm financing is indicated in Table VI.

TABLE VI

TOTAL LOANS OUTSTANDING FOR INSURANCE COMPANIES ON FARM MORTGAGES FOR LOUISIANA AND FOR THE UNITED STATES, 1914 TO 1928‡

(In 1000 Dollars)

Year	Total for U. S.	Total for La.
1914	$ 647,147	$1,379
1915	....	............*
1916	828,734	1,521
1917	923,159	1,496
1918	954,390	1,509
1919	858,537	1,687
1920	1,085,910	3,649
1921	1,306,559	6,015
1922	1,454,206	6,782
1923	1,662,657	7,747†
1924	1,801,619	8,395
1925	1,878,851	8,755
1926	1,941,911	9,049
1927	1,982,548	9,238
1928	1,936,000	9,021

It was estimated that insurance companies held 14 per cent of the total farm mortgage debts in the United States and 7 per cent of the total for Louisiana in 1920.§

Other institutions exist in Louisiana that finance agriculture on first mortgages, but due to lack of information and the fact that most of these are not specialized credit agencies, they will not be discussed here.

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*Data not available.

†These reports did not segregate the farm mortgage loans for Louisiana for 1923 to 1928. Values for these years were estimated. The per cent of farm mortgage loans in Louisiana for 1920, 1921 and 1922 of total farm mortgage loans made by insurance companies was approximately constant. It is assumed that this percentage holds true from 1923 to 1928.

‡Reports of Proceedings of the Annual Meetings of the Association of Life Insurance Presidents. 1914 to 1920, Vol. 16, Exhibit A, p. 160, 1920 to 1928 Annual reports for these years.

§Valgren, V. N. and Engelbert, E. E.—Farm Mortgage Loans by Banks, Insurance Companies and Other Sources. U. S. D. A. Bul. 1047, p. 3.

SECTION II.

FACTORS AFFECTING THE CREDIT NEEDS OF LOUISIANA FARMERS

Apparently, credit needs among Louisiana farmers have been increasing since 1900. This is due in part to (1) the increase in land values up to 1920, (2) more intensive methods of farming, (3) periodic overflows which a large number of Louisiana farmers have experienced in the past few years, (4) the destruction of crops by pests, disease, and floods, (5) the introduction of a more complex marketing system, and (6) the drop in prices of farm commodities in 1920, after heavy obligations had been assumed by many farmers of the State, (7) the increased use of commercial fertilizers which has influenced the amount of credit needed to keep farm production up to normal.

The amount of credit Louisiana farmers need depends upon the type of farming engaged in, and the financial conditions of the farmers in question. Credit needs can not be measured by the requests for loans, neither can they be measured by the amount of loans granted, for in some cases worthy requests are turned down and in others, credit is granted when there is no sound purpose for which the credit is used. Any amount of credit that will help farmers pay their operating expenses on the farm, keep the farm family in a comfortable social position, return a fair wage for labor and help maintain a decent standard of living for the family, which can be repaid with the income from the farm is considered here to be the amount of credit needed by farmers.*

TYPE OF FARMING AS A FACTOR INFLUENCING AGRICULTURAL CREDIT NEEDS IN LOUISIANA

Due to the nature of the soil, location with respect to markets, variation in rainfall from section to section, the length of the growing season, and the different nationalities represented in the population of the State, Louisiana has developed several distinct types of agriculture as are indicated by the map on page 6.

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*See Cary, L. F., Credit needs of the Northwest Small Grain Farmer, Journal of Land Economics and Public Utilities, May, 1929, pp. 180-186.

VALUE OF LAND AND EQUIPMENT

The total value of farm land and buildings in Louisiana was estimated by the Census bureau in 1925, at $324,678,074. This is equivalent to an average value of $2,451 per farm or a value of $36.74 per acre. The buildings alone were valued at $72,940,102, implements and machinery at $21,352,945, and all livestock was valued at $39,899,825. Table VII indicates the value of farms and farm equipment for the different farming areas of the State.

TABLE VII

AVERAGE VALUE OF LAND AND BUILDINGS, MACHINERY, AND LIVESTOCK PER FARM AND PER ACRE FOR THE DIFFERENT FARMING AREAS OF LOUISIANA—1925†

	Land and Buildings		Machinery		Livestock	
Area	Per Farm	Per Acre	Per Farm	Per Acre	Per Farm	Per Acre
Cotton	$1,911.38	$32.64	$113.97	$1.95	$252.38	$4.31
Rice	4,662.22	48.02	403.10	4.15	524.76	5.40
Sugar Cane	5,843.27	45.75	422.14	3.31	585.91	4.59
Fruit and Vegetables	2,544.18	47.32	145.61	2.71	309.94	5.76

The fixed capital requirements for a Louisiana farm varies with the type of farming, as is shown in Table VII. Rice and sugar cane require a heavier investment per farm for the three items listed in the table. Due to the smallness of the size of the fruit and vegetable farm and the intensive methods of cultivation, also the relatively large amount of dairying in the area, the livestock value per acre is above that of the other areas. The average size of farm in the four areas in 1925 was as follows: cotton, 58.51 acres; rice, 97.09; sugar cane, 127.72; and fruit and vegetable farms had an average of 53.77 acres. In the latter, only small acreages are actually cultivated on each farm.

EXPENSES OF CROP PRODUCTION IN LOUISIANA

The cash outlay in producing a cotton crop is quite different from that of producing a sugar cane, rice or berry crop. Very little cost data are available on crop production in Louisiana. However, the larger banks, industrial corporations and other private enterprises have done some work in this connection. The Calcasieu National Bank of Southwest Louisiana, at Lake Charles, Louisiana, has eight branch banks throughout the rice area and data have been collected from a large number of farms by this Institution on the cash expenditures for producing an acre of rice. Over a period of years it has been found that the average expenditure ranges from nineteen to twenty-five dollars an acre. Where farmers depend on one of these banks to finance them, twenty-five dollars an acre is the maximum that is advanced, thereby forcing the cash out-lay within this limit. Cotton farmers are allowed by banks from ten to fifteen dollars per acre on which to produce this crop, cane farmers are advanced thirty-five dollars an acre on plant cane and twenty-two dollars and fifty cents on stubble cane. If fertilizer is used, an additional five dollars is advanced. The strawberry farmer and truck grower are able to borrow fifty dollars an acre on these crops, which is looked upon by the financial institutions as the amount of cash necessary to cultivate and care for one acre.

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†Data Compiled from the Agricultural Census 1925.

The Sugar Operators Inc., located at Houma, Louisiana, have made a study of cost of producing sugar cane in the State, and they report that when seed cane, depreciation on mules and machinery, insurance, taxes and interest on the investment are included, the cost of producing an acre of sugar cane ready for harvest, on the average farm is sixty dollars. With a twenty ton yield per acre—cost of harvesting is approximately one dollar a ton—the total is eighty dollars on the average.* The farmers' credit needs do not ordinarily involve anything other than cash outlay. Any farmer entering the farming business in either of the areas discussed without some capital, will find that his credit needs are approximately the amounts suggested above.

FINANCIAL CONDITION AS A FACTOR IN CREDIT NEEDS

From an analysis of the survey data of 809 Louisiana farms in 1928, it was found that many farmers did not use credit as a means of financing the farm business. Table VIII suggests the number of farmers who were operating on a cash basis during the year of 1928.

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*Information obtained by letter from Sugar Operators Incorporated, Houma, Louisiana.

TABLE VIII

PERCENTAGE OF FARMERS USING NO CREDIT IN 1928 WITH THE PERCENTAGE OF TOTAL ACRES FARMED, PERCENTAGE OF TOTAL CROP SALES, LIVESTOCK SALES AND PERCENTAGE OF TOTAL EXPENDITURES, LOUISIANA SURVEY 1928

Area	Per cent Farmers	Acres Operated Per cent	Crop Sales Per cent	Livestock Sales Per cent	Farm Expenditures Per cent
		Owner-Operators			
Cotton	37.4	64.9	35.8	51.0	37.0
Rice	22.7	16.2	14.3	12.7	17.9
Sugar Cane	29.2	29.6	6.5	57.7	7.9
Fruit and Vegetable	11.5	16.9	12.0	18.5	10.7
		Tenants			
Cotton	15.0	26.4	15.3	64.6	23.9
Rice	0.0	0.0	0.0	0.0	0.0
Sugar Cane	13.8	9.5	6.6	6.3	7.7
Fruit and Vegetable	0.0	0.0	0.0	0.0	0.0

There are three types of farmers included in Table VIII. First, those who are financially independent and who do not necessarily have to depend upon the farm for their income; second, the group that practices a self-sufficing economy or produces what it can on the farm during the summer months and then goes to outside works for the winter, thus acquiring enough ready cash to avoid borrowing during the year; and third, those farmers whose moral and economic standing in the community in such that they are unable to get credit. These cash farmers are not necessarily the most prosperous farmers. Some of them could use credit to an advantage, but due to their ideas of thrift, or perhaps the dread of being obligated to other persons, they refrain from borrowing. Table VIII shows that farmers of the cotton area, more than any other group, operate on a cash basis. It will also be noted that these farmers sell fifty per cent of the total livestock and livestock products of their group. Those who are in the dairy business are able to distribute their income over twelve months in the year and are thereby able to work on a cash basis. The column under farm expenses indicates that these farmers are spending approximately the average for business operations. Thirty-seven per cent of the farmers in the cotton area spend 37 per cent of the total expenditures for their group, and the same ratio holds true for the other groups among the owner-operators with the exception of the sugar cane farmer. Another observation to be made, is that relatively few tenant farmers are able to farm without the use of credit. Most of those who operate on a cash basis are either farmers who work for day wages during the slack season on the farm or those who can not get credit.

The survey data brought out another point of interest, with respect to what farmers owed at the end of 1928. Many were not in a position to start the 1929 crop without aid from some credit institution. Table IX indicates that 24.9 per cent of the owner-operators and 39.8 per cent of the farm tenants were needing assistance when they made their first expenditures for the 1929 operations. Assuming that this condition among farmers at the end of 1928 is a representative sample of what existed, when tenants and owner-operators are combined, (croppers excluded) 29.9 per cent or 29,404 farmers in Louisiana began this year's operations in debt.

TABLE IX

PER CENT OF FARMERS IN LOUISIANA HAVING DEBTS AT THE BEGINNING OF 1929 AND THE AVERAGE AMOUNT EXCLUSIVE OF MORTGAGE DEBTS.

SURVEY 1928

Area	Per cent Owner-Operators	Per cent Tenants	Average Debt Per Farmer
Cotton	19.5	40.9	$ 992
Rice	24.0	28.6	1,238
Sugar Cane	43.8	44.7	4.057
Fruit and Vegetable	23.8	28.0	538
For all Areas	24.9	39.8	1,986

The principal items in the operating expenses of a Louisiana farm are, labor, fertilizer, and feed for livestock. An accurate record of the amount of fertilizer used in the State has been kept by the Commissioner of Agriculture since 1890. The following table gives one an idea of the importance of the fertilizer item.

TABLE X

LOUISIANA'S FERTILIZER TONAGE SINCE 1890†

Year	Tons	Year	Tons	Year	Tons
1890	11,120	1903	76,197	1916	75,151
1891	11,371	1904	95,964	1917	98,264
1892	7,945	1905	94,729	1918	118,429
1893	12,047	1906	84,626	1919	97,724
1894	8,496	1907	102,454	1920	95,863
1895	4,783	1908	84,124	1921	38,760
1896	10,051	1909	83,710	1922	66,470
1897	12,342	1910	88,396	1923	108,712
1898	14,404	1911	91,085	1924	129,288
1899	23,866	1912	85,475	1925	103,989
1900	31,813	1913	98,778	1926	116,049
1901	47,943	1914	90,588	1927	91,095
1902	53,874	1915	74,420	1928	136,324

There is such a variation in the price of commercial fertilizers from year to year as well as between grades that one can not judge from the tonnage figures the amount of money spent for fertilizer. The number of tons used is a fair barometer of the crop incomes from the preceding year. A good crop with fair prices leads to heavier applications of fertilizer the following year as is evidenced by the tonnage used during the periods 1914 to 1917, 1920 to 1922, and 1926 to 1928.

The amount of money spent by Louisiana farmers during 1924 for labor, feed and fertilizer is as follows: labor $11,855,948; feed $10,120,935; and fertilizer $4,179,756. The number reported using fertilizer was 54,412, hiring labor, 27,191, and those who reported buying feed numbered 66,910.‡

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†Data furnished by the Commissioner of Agriculture and Immigration for Louisiana.

‡Census of Agriculture, 1925, Part II, p. 25.

TABLE XI

AVERAGE AMOUNT EXPENDED AND PERCENTAGE DISTRIBUTION OF EXPENDITURES ON 809 FARMS IN LOUISIANA 1928. FARM SURVEY 1928

AREA	Expenditure Per Farm	Feed	Seed and Fertilizer	Labor	Machinery	Livestock	Groceries	Other Expenditures*
OWNER-OPERATORS								
Cotton	$1976	26.1	6.3	22.7	5.6	7.7	19.6	12.0
Rice	5531	4.5	7.6	31.1	21.4	1.4	6.2	27.8
Sugar Cane	7482	10.3	4.4	43.7	2.7	6.4	8.2	24.3
Fruit and Vegetable	1574	7.2	11.6	21.4	0.0	0.0	36.5	23.3
Total	$1,761,472	12.8	6.5	32.5	7.6	4.8	14.1	21.7
TENANTS								
Cotton	1114	13.0	6.0	4.0	5.1	4.6	36.6	30.7
Rice	3435	6.2	6.9	22.1	20.1	0.6	8.0	36.1
Sugar Cane	1312	19.0	6.0	19.7	2.3	2.2	29.3	21.5
Fruit and Vegetable	1346	5.4	12.8	11.5	0.0	0.0	38.9	31.4
Total	$345,963	12.5	6.9	15.3	7.8	2.2	26.3	29.0

The above data, Table XI, bring out the relative importance of expenditures on farms in the different cropping areas. The average per farm is much greater in the cane and rice sections than in the cotton, and fruit and vegetable sections. Labor is the most important single item, averaging 32.5 per cent of the total expenditures for owner-operators and 15.3 per cent for tenants. Due to the fact that more fertilizer was used during 1928 than ever before in the history of Louisiana's agriculture—see Table X, page 27, the proportion spent for this item is above the normal. However, the farm leaders are advocating heavier applications of fertilizer in most sections. This means more credit for those who are not in a position to pay cash for this product. A measure of long-term credit needs is difficult to determine. The amount of this type of credit used is brought out in a later section. Apparently, the greatest need for long-term credit, at present, is to pay existing debts. Very little is used to buy lands, or put improvements on the lands.

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*Other expenditures include such items as hauling, crates, twine, bags, doctor bills, ginning, taxes, and many other items.

The fall in prices in 1920 and the fact that prices of farm products fell more than other products left agriculture at a disparity with other industries in general. This has been responsible, in part, for the increased demands for credits since 1920. Table XII points out the difference in prices farmers received for their products and the price they paid for the commodities they used on the farm.

In 1919, the purchasing power of farm commodities had the advantage over other commodities in general but since that time, conditions have been the reverse. The ratio for 1921 shows that it required 100 cents in farm commodities to exchange for 75 cents of commodities that entered into the farmers' budget. Conditions, however, have improved, and in September, 1928, the ratio was 91. Under these circumstances, it seems that farmers would give more attention to production for home consumption. However, there is no indication that this has been done. During 1928, the value of home produced and consumed farm products—including both farm and livestock products—averaged $237.55 as estimated by 809 farmers. Of this amount $84.06 represented the amount of fruits and vegetables used from the farm, and $153.47 the amount of livestock and livestock products. The average grocery bill at the store was $419.72, which is approximately two-thirds of the annual food bill.

TABLE XII

INDEX NUMBERS OF PRICES RECEIVED AND RETAIL PRICES PAID BY FARMERS 1919 TO 1928.† (1909-1914= 100)

Year	Retail Prices Paid for Commodities used in Living and Production	Prices Received For Farm Products	Ratio of Prices Received to Prices Paid
1919	205	209	102
1920	206	205	99
1921	156	116	75
1922	152	124	81
1923	153	135	88
1924	154	134	87
1925	159	147	92
1926	156	136	87
1927	154	131	85
*1928	156	141	91

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*September Index.

†Crops and Markets, Feb. 1929, Vol. 6, No. 2, p. 79.

TREND IN CREDIT NEEDS

The farmers reaction to the question of credit needs varied considerably. Whether a farmer needs more or less credit now than he did 5, 10, or 15 years ago depends upon other than purely economic conditions of agriculture. In the growing family the needs are different from those of the family where no one is left except the parents. The survey data give, in a measure, the trend of credit needs. The question, "Do you need more credit now, the same, or less than you did 5 years ago? 10 years ago? 15 years ago?" was included in the schedule for farmers. This question was answered by a large majority of the farmers who cooperated in the study. The younger farmers were unable to give information on the earlier periods. Answers to the question are tabulated in Table XIII.

TABLE XIII

TREND IN CREDIT NEEDS AS INDICATED BY 809 FARMERS IN LOUISIANA 1928 SURVEY

Tenure Status	RELATIVE TO NEEDS								
	Five Years Ago			Ten Years Ago			Fifteen Years Ago		
	More	Same	Less	More	Same	Less	More	Same	Less
OWNERS:									
Number	176	233	77	183	187	52	166	170	44
Percentage	36.2	47.9	15.9	43.4	44.3	12.3	43.7	44.7	11.6
TENANTS:									
Number	110	69	84	107	72	67	77	59	59
Percentage	41.8	26.2	32.0	43.5	29.3	27.2	39.4	30.3	30.3
BOTH:									
Number	286	302	161	290	259	119	243	229	103
Percentage	38.2	40.3	21.5	43.4	38.8	17.8	42.3	39.8	17.9

Forty per cent of the farmers reporting, indicated that their credit needs had not changed within the past five years; 38.8 per cent made a similar report when comparing credit needs of the present to credit needs of ten years ago. The past fifteen years have not brought about a change in credit needs for 39.8 per cent of the farmers reporting. A relatively small per cent indicated that their credit needs are growing less, while a large per cent have greater needs for credit than in former years.

SECTION III.

AVAILABILITY AND USES OF AGRICULTURAL CREDIT IN LOUISIANA

AGRICULTURAL CREDITS DEFINED AND CLASSIFIED

As used in this discussion, agricultural credits mean, the obtaining from another at a given time the temporary use of money or supplies that are to be used for agricultural purposes, which are to be repaid at some future date, the chief basis for this transaction being confidence. This definition includes cash credits from banks and other sources as well as feed, fertilizer, farm tools and supplies, and any other commodity that is received by the farmer at a given time for a future consideration.

Recent literature on agricultural credit includes a discussion of three classes of credit; namely: short-term credit, intermediate credit, and long-term credit. They are differentiated on the basis of, (1) kind of security required; (2) the amount of the loan; and (3) the length of time the loan runs.*

It is difficult to classify agricultural credit in Louisiana on any of the bases mentioned above. Personal and collateral loans are mainly short-term or intermediate loans, and mortgage credit, as a rule, is long-term credit. There are many exceptions to this, however. Some large loans are made to Louisiana farmers on personal or collateral security while some small loans require a mortgage on the farm as security. Again, mortgage loans are made for less than six months by some lending agencies. It is possible to find most of the credit agencies extending the three classes of credit. It depends upon the borrower as well as the purpose of the loan. Strictly speaking, short-term credit, when based on the time element, is credit for six months or less, intermediate credit runs from six months to three years, and long-term credit is considered that which extends for a period of more than three years.

For convenience, all personal and collateral loans obtained from local banks, merchants and local farm associations are classed as short-term loans. Those loans that are advanced by the Intermediate Credit bank are classed as intermediate credit, and those loans that are obtained from banks, insurance companies, Federal land banks and other agencies that are secured by farm mortgages are classed as long-term credit.

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*Morman, J. B., Farm Credits in The United States and Canada, p. 288.

SHORT-TERM CREDIT

The important agencies that supply Louisiana farmers with short-term credit are: local banks, merchants and farm associations. Due to the lack of published information on short-term credit in this State, it is necessary to rely upon survey data as a basis for the greater part of the discussion on this phase of the work.

TABLE XIV

PERCENTAGE DISTRIBUTION OF FARMERS USING BANK CREDIT, AVERAGE AMOUNT PER BORROWER AND AVERAGE AMOUNT PER CLASS IN FOUR FARMING AREAS OF LOUISIANA, 1928

Area	Owner Operators	Tenants	Total
	Per cent of Farmers Borrowing:		
Cotton	34.4	20.5	29.6
Rice	44.0	25.0	38.8
Sugar Cane	15.7	4.3	9.8
Fruit and Vegetable	28.5	24.0	27.7
Average*	31.2	15.7	25.9
	Average amount per Borrower:		
Cotton	$ 841.41	$276.92	$ 706.76
Rice	2,118.94	610.71	1,855.00
Sugar Cane	10,799.57	234.25	8,451.72
Fruit and Vegetable	371.97	100.00	344.02
Average	$1,824.66	$302.83	$1,513.00
	Average for all Farmers in Survey:		
Cotton	$ 289.78	$ 56.69	$ 209.34
Rice	932.33	152.68	720.39
Sugar Cane	1,698.80	9.97	831.32
Fruit and Vegetable	105.87	24.00	92.66
Average	569.57	47.52	392.75

Approximately one-fourth of the farmers in Louisiana are using loans from local banks as indicated by Table XIV. With owner-operators, the number using credit ranges from 15.7 per cent of the sugar cane farmers to 44 per cent of the rice farmers. A smaller per cent of tenant farmers use bank loans, ranging from 4.3 per cent in the cane area to 25 per cent in the rice area.

In the sugar cane area, local banks have practically withdrawn from the field of extending production credit on the cane farms. The uncertainty of the crop and the low prices that have prevailed in this section have increased the risk involved in such loans to the extent that the banks are using a very rigid selective process in making agricultural loans. Tenant farmers, in all areas, do not depend upon bank credit to any great extent. They look to their landlords or to the local merchants for advances for the year.

The average amount borrowed by the four classes was $1,824.66 for owner operators and $302.83 for tenants, or an average of $1,513 for both groups. The large amount indicated for cane farmers tends to exaggerate the average for the State as these loans went to a relatively few big planters who have a high credit rating, and are not representative of any other section included in this survey outside of the cane area.

When all farmers of these areas are considered, the bank loans are rather small, averaging only $569.57 for owner-operators and $47.52 for farm tenants. This gives an average of $392.75 for both classes combined. The main purpose of Table XIV is to give a comparison of the importance of bank credit between areas and between owner-operators and tenants within the same area.

PURPOSES FOR WHICH BANK LOANS ARE USED

Some bankers in the State have not made it their policy to learn the purposes of loans that are made to farmers. If the credit rating of the person borrowing is good, he gets the loan regardless of the purpose. On the other hand, there are bankers in the State who know how their loans are being used and if the purpose of the loan is not sound, the farmer is discouraged from borrowing. Farmers, too, are slow to make application for loans unless they feel that the additional capital will aid in their production program sufficiently to justify the expense and risk involved.

The purposes for which loans are used by farmers in the different areas are suggested in Table XV. It will be noted that cotton and fruit and vegetable farmers borrow for many more purposes than do farmers of the rice and sugar areas. This difference is due primarily to the restrictions placed on the rice and cane farmers by the banks making the loans. In these two areas 97 and 98 per cent of all loans were made in order to pay operating expenses.* For the four areas, 92.5 per cent of bank loans made to owner-operators and 89 per cent made to tenants, were used for operating expenses.

Some of the more progressive farmers are using bank credit and paying cash at the store rather than using the more expensive merchant credit. This practice is prevalent among tenants as well as among farm owners. Merchants are equally important in bringing about this practice among farmers, as they are restricting their sales to cash business or to thirty day business in many sections.

TABLE XV

PERCENTAGE DISTRIBUTION OF BANK LOANS TO FARMERS IN FOUR AREAS OF LOUISIANA ACCORDING TO PURPOSE. SURVEY 1928

Purpose	Cotton Area	Rice Area	Sugar Cane Area	Fruit and Vegetable Area	State Average
	Owner-Operators				
Operating Expense	81.0	97.0	98.0	49.0	92.0
Building and Improvement	1.0		.2	2.0	.5
Livestock	.5			2.0	.2
Equipment and Machinery	4.0			1.0	1.0
Pay other Debts	1.0			3.0	.3
Houshold Expense	3.5		1.5	39.0	3.0
†Miscellaneous	9.0	3.0	.3	4.0	3.0
	Tenant-Operators				
Operating Expense	92.5	97.0	63.0	25.0	89.0
Building and Improvement				8.0	1.0
Livestock			32.0		2.0
Household	7.0			59.0	6.0
Miscellaneous	.5	3.0	5.0	8.0	2.0

SECURITY GIVEN FOR SHORT-TERM BANK LOANS

There is a wide variety of forms of security given by farmers for bank loans. With the owner-operator, the plain personal note‡ is the most common form used, while for tenant farmers, the crop lien note is the most prevalent form. Personal notes indorsed by a second party are used to some extent by tenants, especially those in the rice area. The different forms of security as reported by farmers using bank loans are shown in Table XVI.

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*Operating expenses include cash expenditures for labor, feed, seed, fertilizer and other items that do not directly add to the inventory of the farm.

†Includes doctor bills, education, recreation, and automobiles.

‡Personal note is used in this discussion to mean a note that is not indorsed by a second party.

TABLE XVI

PERCENTAGE DISTRIBUTION OF BANK LOANS TO FARMERS IN FOUR FARMING AREAS IN LOUISIANA ACCORDING TO SECURITY GIVEN. SURVEY 1928

Security	Cotton Area	Rice Area	Sugar Cane Area	Fruit and Vegetable Area	Average for all Areas
	Owner-Operators				
Crop Lien	15.9	22.3	.1	26.1	10.0
Personal Note	52.5	53.7	69.1	54.9	61.1
Chattel Mortgage	11.3	9.4	23.3	....	16.3
Indorsed Note	13.2	.9	....	11.7	3.8
Crop Lien and Chattel Mortgage	2.2	11.5	....	....	3.1
*Other Security	4.9	2.2	7.5	7.3	5.7
	Tenant-Operators				
Crop Lien	62.4	16.4	56.3	....	44.0
Personal Note	18.3	....	32.0	58.3	15.1
Chattel Mortgage	.....	....	6.4	....	.5
Indorsed Note	14.9	83.6	5.3	41.7	38.0
Crop Lien and Chattel Mortgage	.4	....	....	....	.2
Other Security	4.0	....	....	....	2.2

For Tenant and Owner Operators All Sections

Crop Lien	11.4
Personal Note	59.2
Chattel Mortgage	15.6
Indorsed Note	5.2
Crop Lien and Chattel Mortgage	3.1
Other Security	5.5

The above data indicate that tenant farmers do not enjoy as high a credit rating as that given owner-operators. Sixty-one per cent of the bank loans made to farm owners and 15 per cent to

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*Includes stocks and bonds, receipts against stored products.

tenants were secured by personal notes according to data obtained from farmers. Banks of the same area were interviewed and asked to estimate the percentage of personal and collateral loans made to farmers on the basis of personal notes. The percentage suggested by bankers was much less than the figure in the above table. It is a well known fact that banks do lend money on personal notes to farmers who have a good record and possess real estate and other property. The data on this point, which were received from the two groups are doubtless biased. Farmers have a tendency to overrate themselves with respect to their credit standing and bankers are likely to under-estimate the amount of loans that are made without some tangible security, as they do not care to make public the fact that their loan policies are not in accord with the best banking practices.

Investigators in other states found that commercial banks make a relatively large number of personal loans on unindorsed personal notes. Gile and Black, in Minnesota, found that 70 per cent of the personal and collateral loans made to owner-operators were secured by personal notes, and 15 per cent of loans to tenant farmers were secured by personal notes.* Lee, in Texas, found that 25.8 per cent of such loans to farmers in Texas were secured by personal note.† A study made in the Altheimer District of Arkansas,‡ by Gile and Moore, revealed the fact that 59 per cent of the bank short-term loans were made on personal notes. In 1920, the United States Department of Agriculture made a study of personal and collateral bank loans to farmers in the United States, and in this study, forty Louisiana bank reports were included. It was found that 15.5 per cent of the loans to farmers in Louisiana were secured by personal notes and 52.7 per cent were secured by indorsed notes.§

Other than the two forms, personal notes and indorsed notes, the bankers and farmers are in close agreement according to data obtained from them.

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*Gile and Black, Agricultural Credit Situation in Minnesota, Technical Bul. 55, p. 55.

†Lee, V. P., Short-Term Farm Credit in Texas, Texas Bul. 351, p. 7.

‡Gile and Moore, Farm Credit in a Plantation and an Upland Cotton District in Arkansas, Bul. 228, p. 29.

§Valgren and Engelbert, Bank Loans to Farmers on Personal and Collateral Security, U. S. D. A., Bul. 1048, p. 21.

Crop lien notes as security for loans are becoming more important in the State. In 1920 Valgren found that 5.2 per cent of the loans were secured in this manner, and in 1928 the crop lien was used to secure 13.7 per cent of the short-term loans made to Louisiana farmers, as reported by banks, and 11.4 per cent as reported by farmers. This increased use of the crop lien note is due perhaps to crop insurance possibilities, improved methods of growing crops even under unfavorable conditions—as better drainage and irrigation facilities—and the agricultural depression which has made the crop lien note about the only form of security that a number of farmers have to offer.

TERM OF LOANS

It is generally considered that local bank loans are made for six months or less, but in Louisiana, the personal and collateral loans from banks vary from thirty days to twelve months. It depends upon the type of farming to a great extent as to how long these loans run. Table XVII gives a comparison of term of loans between farming areas as well as the percentage of loans for the different periods. Cotton farm owners used 73.5 per cent of their bank loans for a period exceeding six months, renewals not included, while tenants in the same area used 37.4 per cent of the loans for a longer period than six months. The two combined used 70.4 per cent of their loans for a period exceeding six months. Due to the nature of the cotton crop, the long growing season, the necessity of making fertilizer purchases early in the year, and the demand for extra labor during the chopping season, it has been made necessary for cotton farmers to apply for loans from six to twelve months in advance of the marketing season.

In the rice area, the majority of loans are made for a period of six months or less. This is true for both owners and tenants, being 56.4 and 64.7 per cent respectively. Rice farming is different from cotton farming, so far as the financing of the crop is concerned. There is not the necessity for the extra hand labor at the beginning of the crop season, neither is the practice of making large expenditures for fertilizer common. The greatest need for cash on the rice farm is just before the harvest season when heavy expenditures are made for repairs, new machinery and supplies.

TABLE XVII

TERM OF PERSONAL AND COLLATERAL LOANS TO FARMERS FROM LOCAL BANKS BASED ON 210 FARM RECORDS IN FOUR AREAS OF LOUISIANA. 1928 SURVEY

Cotton Area

Term	Per cent of Total to Each Class: Owner	Tenant	Both
Less than 60 days	7.2	....	6.5
60 to 90 days	1.2	.7	1.0
3 to 6 months	18.1	61.9	22.1
6 to 9 months	33.6	25.7	32.8
9 to 12 months	39.7	11.7	37.4
12 months and over	.2	....	.2
Total Percentage	100.0	100.0	100.0
Total Amount	$ 68,837	$ 7,210	$ 77,047

Rice Area

Term	Owner	Tenant	Both
Less than 60 days	.1	4.7	.4
60 to 90 days	10.2	48.3	12.4
3 to 6 months	46.1	11.7	44.1
6 to 9 months	6.0	35.3	7.7
9 to 12 months	37.6	....	35.4
12 months and over	....	....	....
Total Percentage	100.0	100.0	100.0
Total Amount	$ 69,925	$ 4,275	$ 74,200

Sugar Cane Area

Term	Owner	Tenant	Both
Less than 60 days	.1	32.0	.3
60 to 90 days	63.8	5.3	63.4
3 to 6 months	.1	....	.1
6 to 9 months	2.3	....	2.3
9 to 12 months	33.7	62.7	33.9
12 months and over	....	....	....
Total Percentage	100.0	100.0	100.0
Total Amount	$151,194	$ 937	$152,131

TABLE XVII—Continued

Term	Owner	Tenant	Both
Small Fruit and Vegetable Area			
Less than 60 days	1.1	....	1.1
60 to 90 days	6.4	16.7	6.8
3 to 6 months	20.8	33.3	21.3
6 to 9 months	41.9	16.7	40.9
9 to 12 months	29.8	33.3	29.9
12 months and over	....	....	....
Total Percentage	100.0	100.0	100.0
Total Amount	$ 13,763	$ 600	$ 14,363
All Areas Combined			
Less than 60 days	1.8	4.9	1.9
60 to 90 days	34.6	17.2	33.9
3 to 6 months	15.7	39.2	16.7
6 to 9 months	12.1	26.3	12.7
9 to 12 months	35.8	12.4	34.8
12 months and over	....	....	....
Total Percentage	100.0	100.0	100.0
Total Amount	$304,569	$13,172	$317,741

Loans to owner operators in the cane belt are usually 60 to 90 day loans or 9 to 12 month loans. Loans to tenants are for a period less than 60 days for 32 per cent, and 9 to 12 months for 62.7 per cent of the loans. Sugar cane requires a long growing season, being planted either in the fall or very early in the spring and harvested during the following fall months, usually in October, November and December. If renewals are taken into account, loans in the cane belt run for considerably over six months. The 26 banks reporting on renewals of personal and collateral loans indicated that approximately 13 per cent of these loans were renewed and a large proportion of these was made in the cane belt. Early demands for cash to pay fertilizer bills and farm labor on the cane plantations require that loans be made in the spring months.

While there is a relatively small amount of bank credit used by fruit and vegetable growers, the longer period loan is demanded. A glance at the fruit and vegetable section of Table XVII will show that 70.8 per cent of the bank loans run for a period longer than six months. Heavy applications of fertilizer and the abundance of hand labor required cause the fruit and vegetable grower to seek credit early in the season. Bankers in the different areas recognize the needs of agriculture, and indications are that they are making their loans for periods that correspond to these needs.

CHANGES IN POLICIES OF FINANCING AGENCIES

Some of Louisiana's farmers have been slow to apply business methods on the farm. The efforts of extension workers and agricultural leaders of the State have been practically fruitless, so far as measurable results are concerned, in dealing with a certain class of farmers. These leaders have not had a force that could be applied which would cause the poorer class of farmers to adopt a better system of agriculture or to improve the methods and system that were already in use. The officials of some of the more progressive credit agencies have recently realized that they must exert the force of restricting credits unless business methods were applied on the farm. This restriction has resulted in improved conditions in several localities of the State.

Those farmers who do not have first class credit rating with the credit institutions are required to submit a financial statement of their farm business before a loan is considered. If the statement indicates such action advisable, a loan is made but not until after a farm budget has been definitely decided upon by the lending agent and the farmer. The amount of the loan is left with the credit institution as a credit deposit. Every item of expenditure from this loan must be listed by the farmer and made available to the lender. This places the creditor in a position where he knows how the funds are being used and it forces the farmer to use them only for stipulated purposes on the farm. In this way, cash expenditures on the farm have been reduced and more economical production has resulted. The farmer who has a high per acre expenditure without showing corresponding results in yields, is given a limited time in which to reduce the expenses of production to the average for his community. If the cash expenditures are not reduced to this level, the credit agency will not continue to furnish credit. Bankers and farmers claim that this system is bringing about better methods of agriculture and that it is resulting in better conditions for both lending and borrowing groups. Prior to the agricultural depression which followed the World War, it was an unusual practice for the banker or other credit agents to advise the farmer as to how he should handle the business on the farm, and how much credit he should obtain in order to keep within safe limits. On the other hand, during the period of rising prices from 1915 to 1920, some farmers were encouraged to use a great deal more credit than they thought it best to use. Experiences have been related by Louisiana farmers, indicating that bankers would suggest a loan of $2,000.00 where $1,000.00 was requested. This easy credit during these years placed many of the farmers in the difficult position they found themselves during the period following 1920.

Another unique practice is found among a few bankers of the State, in helping farmers to liquidate old debts. Where there are several creditors concerned, the banker demands that all surplus over current expenses be divided among the creditors according to the proportion that each debt is of the whole debt. The farmer is given the privilege of taking a small percentage of the surplus for his own private use, but every debt that he owes is given its proper share of the profits made on the farm. This practice is helping the farmer to maintain his credit rating and at the same time his debts are gradually paid.

MERCHANT CREDIT

Out of a total of 809 farmers cooperating in this study, 381, or 47.1 per cent, used merchant credit. This suggests that merchants of Louisiana supply a large number of farmers with credit during the year. A number of farmers who are able to borrow money from the bank or other agencies at a normal rate of interest, use merchant credit and pay a high rate of interest on the account and in addition a credit price which is above the cash price. It is possible that these farmers do not know of the cheaper sources, or due to the inconvenience of securing loans from the banks, they prefer to use merchant credit. Table XVIII indicates the number of farmers in the different areas who are using merchant credit also the average amount used.

TABLE XVIII

PER CENT OF FARMERS USING MERCHANT CREDIT AND AVERAGE AMOUNT USED PER FARMER IN FOUR FARMING AREAS OF LOUISIANA. SURVEY 1928

Area	Per cent Owners	Per cent Tenants	Per cent Both
Cotton	43.6	57.5	48.3
Rice	64.0	78.6	67.9
Sugar Cane	39.3	35.1	37.1
Fruit and Vegetable	40.0	52.0	41.9
Per cent for total	44.9	51.5	47.1
Number using merchant credit	210	141	381
Total number of farmers	535	274	809
	Average Amount Per Person		
Cotton	$ 526.50	$ 338.20	$ 449.05
Rice	763.18	626.86	720.34
Sugar Cane	836.22	560.42	702.38
Fruit and Vegetable	423.13	465.15	431.53
Average for all areas	596.61	446.67	541.12
Total Merchant Credit	$143,187.00	$62,981.00	$206,168.00

A small per cent of farmers in the cane area used merchant credit as compared with farmers in other areas but the average amount for each was greater in this area. This suggests that merchants in the cane area were using a selective process in determining their credit customers more so than the merchants in other areas. This is also accounted for by the fact that landlords do a great amount of financing, thus resulting in large loans. Owner-operators used more merchant credit per person than did tenants. This difference is based primarily on the ability to get credit. Tenants would use more credit from the merchants if they could get it, according to statements from merchants as well as from tenants themselves. Landlords as a rule, "stand good" for the tenants at the store and the merchants advance only up to the amount designated by the landlord.

TERM OF MERCHANT CREDIT

Merchant credit like bank credit is extended for periods according to the nature of agriculture in the community. There is little variation in the term of the loan from that which was given for bank credit Table XVII. The distribution of merchant credit on the basis of term of loan is shown in Table XIX.

TABLE XIX

PERCENTAGE DISTRIBUTION OF MERCHANT CREDIT ON THE BASIS OF TIME ACCOUNTS RUN IN FOUR AREAS OF LOUISIANA. SURVEY 1928

Time	Owner	Tenant	Both
	Cotton Area		
60 days and less	21.5	....	14.8
60 to 90 days	.1	....	.1
3 to 6 months	9.1	15.3	11.0
6 to 9 months	24.0	56.4	34.0
9 to 12 months	44.1	25.2	38.3
Not reported	1.2	3.1	1.8
Total	100.0	100.0	100.0
Amount	$ 55,283	$24,649	$ 79,932
	Rice Area		
60 days and less	10.7	....	7.8
60 to 90 days	1.4	3.9	2.0
3 to 6 months	84.6	86.8	85.2
6 to 9 months	2.8	6.4	3.8
9 to 12 months	....	2.9	.8
Not reported	.5	....	.4
Total	100.0	100.0	100.0
Amount	$ 36,633	$13,791	$ 50,424
	Sugar Cane Area		
60 days or less	.2	.0	.1
60 to 90 days	.0	.5	.2
3 to 6 months	5.2	4.4	4.9
6 to 9 months	8.0	3.0	6.1
9 to 12 months	83.4	86.4	84.5
Not reported	3.2	5.7	4.2
Total	100.0	100.0	100.0
Amount	$ 29,268	$18,494	$ 47,762

TABLE XIX—Continued

Fruit and Vegetable Area

Time	Owner	Tenant	Both
60 days and less	12.7	1.5	10.3
60 to 90 days	.5	.0	.4
3 to 6 months	4.3	.0	3.4
6 to 9 months	26.5	28.5	26.9
9 to 12 months	47.2	70.0	52.1
Not reported	8.8	.0	6.9
Total	100.0	100.0	100.0
Amount	$ 22,003	$ 6,047	$ 28,050

For all Areas

Time	Owner	Tenant	Both
60 days and less	13.0	.1	9.1
60 to 90 days	.4	1.0	.6
3 to 6 months	26.9	26.3	26.7
6 to 9 months	15.7	27.1	19.2
9 to 12 months	41.3	42.6	41.7
Not reported	2.7	2.9	2.7
Total	100.0	100.0	100.0
Amount	$143,187	$62,981	$206,168

Of all merchant credit 63.6 per cent was extended for longer than six months. The rice farmers are the only ones using merchant credit for a period of less than six months to any great extent.

SECURITY REQUIRED FOR MERCHANT CREDIT

A comparison of the security required for merchant credit as indicated by 38 merchants and the farmers using merchant credit is made in Table XX. Any analysis of each of the areas shows that merchants extend most of their credit on open account. In the cotton, rice, and fruit and vegetable areas the percentage of credit on open account is 74.8, 78.5, and 69.7 per cent respectively, in the sugar cane area the crop lien note is the most important form. It is used to secure 59.1 per cent of merchant credit in this area.

TABLE XX

PERCENTAGE DISTRIBUTION OF CREDIT OBTAINED FROM MERCHANTS BY FARMERS IN LOUISIANA, ON THE BASIS OF SECURITY GIVEN. SURVEY 1928

Form of Security	As Reported by Farmers	As Reported by Merchants
Open Account	65.2	62.2
Crop Lien	19.4	14.2
Chattel Mortgage	1.8	4.1
Personal Note	11.4	13.3
Indorsed Note	2.2	3.3
Other Security	....	2.0
Not Reported	....	.9
Total	100.0	100.0
Amount involved	$206,168	$670,335

Data for the different areas show that a greater number of tenant farmers obtain credit on open account than do owner-operators. This does not indicate that tenant farmers have a higher credit rating than farm owners. The main reason why a greater percentage of tenants use open accounts is because a large number of landlords are in the mercantile business and they make advances to tenants through the store. Close supervision is maintained over tenants' operations by the merchant and the amount of credit that can be safely advanced is determined by the progress of crops on the farm. The owner-operator is not supervised by the merchant neither does the merchant have anything to do with the marketing of his crops as is the case with tenants. Although tenant accounts are listed as book accounts, in reality the crops produced on the farm are the securities which back the credit extended. Merchants do not allow these crops to be marketed without their permission. This makes it possible for credits, that have been granted during the year, to be paid out of the first receipts. The owner-operator can not be controlled in this manner by the credit merchant unless there is a crop lien given as security.

PURPOSE OF MERCHANT CREDIT

Most farmers were unable to list the separate items obtained through merchant credit, therefore, it is impossible to give the purposes of such credit. Farmers knew what their grocery bills were per month and also the amount of expenditures for feed, fertilizer and machinery, but other items were not reported separately.

The 38 merchants reporting, indicated that their business for 1928 amounted to $1,519,112 and of this amount, $1,099,667, or 72.4 per cent, was farm business. Ninety-one per cent of the total credit extended by these merchants was to farm people, and 60.9 per cent of the sales made to farmers were credit sales. Many mercantile businesses in Louisiana are depending on agriculture directly for their existence.

FARM ASSOCIATION CREDIT

The associations, which have been described in Chapter III, operate in the fruit and vegetable area of the State primarily, and their function is to advance credit to farmers in the form of cash or supplies. During 1928, 74.6 per cent of the owner-operators and 88 per cent of the tenant farmers in this area used association credit. The average amount per borrower was $681.35. Owner-operators used on the average $705.69 during the season of 1928 and tenants used $505.16. These associations do very little business on open account. The main form of security is the crop lien note. Table XXI shows how the loans are distributed with respect to security required.

TABLE XXI

PERCENTAGE DISTRIBUTION OF CREDIT OBTAINED BY FARMERS IN THE FRUIT AND VEGETABLE AREA OF LOUISIANA FROM FARM ASSOCIATIONS. SURVEY 1928

Security	Owner-Operator	Tenants	Both
Open Account	.2	....	.1
Personal Note	4.9	....	4.2
Indorsed Note	7.5	4.5	7.0
Crop Lien Note	87.4	84.5	87.0
Crop Lien with Indorsement	....	11.2	1.7
Total	100.0	100.0	100.0
Amount	$68,452	$12,629	$81,081

TERM OF LOAN

As was indicated in the preceding sections, the truck farmer needs credit for practically the entire year. The farm associations handle their business on a six to twelve month basis. Of the total loans, 71.2 per cent are made for a period of nine to twelve months. Approximately 5 per cent of the loans are made for six months or less. Most of the loans are for sufficient time to allow a farmer to plant, harvest, and market the crops.

Schedules were obtained from twelve of these associations in order to learn their business practices. It has been pointed out already that the form of organization varies from a private enterprise to a corporation form. Two were found to be private businesses, one, a partnership, two corporations, and the remainder were cooperative in form. The tendency is for the cooperative forms to reorganize and become corporations. Two of these have done so since the survey was made. The cooperatives have not been able to build up a surplus fund with which to operate during bad seasons or to put themselves on a good standing with the banks and other financing agencies, when it is necessary for them to borrow funds.

The associations interviewed, served 1,649 farmers during the 1928 season. Farmers purchased through these agencies supplies amounting to $269,409. The total amount of credit extended was $446,226, of which $186,613 was cash. These associations sold for their members $1,924,747 worth of farm products. This leaves a wide margin between the amount of credit advanced and the total receipts.

The term of credit and the security required as reported by those associations are practically the same as were reported by the farmers of this area.

INTERMEDIATE CREDIT

Data that have been presented up to the present time are samples which are given as representative of the whole. The data that are to be used in connection with the discussion on intermediate credit are complete, since we are to deal only with the activities of the Intermediate Credit Bank, located at New Orleans. It is true, however, that there is likely to be an overlapping with the credit which we have already considered, for some of the associations discount paper with the Intermediate Credit Bank.

Attention has already been called to the types of loans the Intermediate Credit Bank makes. Table XXII shows the importance of these loans in different farm areas of the State.

TABLE XXII

LOANS MADE BY THE INTERMEDIATE CREDIT BANK TO FARMERS IN DIFFERENT AREAS OF LOUISIANA FROM 1924 TO 1928*

Year	—Production Loans— Amount	Per cent Increase	—Commodity Loans— Amount	Per cent Increase	Per cent Cotton Loans of Total Loans
			Cotton		
1924	$ 9,590	....	....	....	.7
1925	11,910	24.2	....	....	.3
1926	55,775	368.3	....	....	1.2
1927	90,176	61.7	....	....	1.4
1928	98,170	8.9	....	....	2.0
Total	$ 265,621				1.2
			Rice		
1924	$ 281,172	....	$ 552,221	....	58.0
1925	839,500	198.6	695,396	25.9	39.9
1926	968,039	15.3	2,321,178	233.8	72.6
1927	1,950,247	101.5	2,975,713	28.2	75.3
1928	1,736,999	10.9	1,199,240	59.7	58.3
Total	$5,775,957		$7,743,748		65.7
			Sugar Cane		
1924	$ 592,750	....	....	....	41.3
1925	2,258,837	281.1	....	....	58.7
1926	1,067,856	52.7	....	....	23.5
1927	1,325,293	24.1	....	....	20.3
1928	1,913,417	44.4	....	....	38.0
Total	$7,158,153				33.5
			Strawberry		
1924	....	....	....	....	....
1925	39,441	....	....	....	1.0
1926	100,136	153.9	20,275	....	2.7
1927	87,775	12.3	110,385	444.4	3.0
1928	84,316	3.9	....	....	1.7
Total	$ 311,668		$ 130,660		2.5

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*Data compiled from information furnished by Intermediate Credit Bank of New Orleans.

According to the data presented in Table XXII most of the Intermediate Credit Bank loans are flowing into the rice and sugar cane areas. Sixty-five per cent of the total loans have been in the rice area and 33.5 per cent were made to the farmers of the cane area. All sections have been using production loans but commodity loans are being used almost altogether by rice farmers and cattle men in the rice area. It will be noted that this class of loans is decreasing. The rate of increase is slowing down in the cotton area and there was an absolute decrease in the amount of loans made from 1927 to 1928 in the rice and strawberry sections. The sugar cane area increased its borrowings during the same period. This suggests that commercial banks supply this class of credit when they have an abundance of loanable funds and when this fund is reduced, the Intermediate Credit Bank supplies the necessary loans. In the rice area, a large amount of loanable funds was acquired by a group of banks a few years ago from oil lands which they held and this has made it possible for these banks to meet the needs of agriculture, thus accounting in part for the decrease in the amount of loans made by the Intermediate Credit Bank. In the cotton area, facilities for handling intermediate credit funds have not developed. In 1928, there was only one credit corporation in operation, serving cotton farmers. The secretary of this corporation stated that it would be necessary to discontinue its operations on account of the small volume of business. The agricultural credit corporations that were in operation in 1928 are:

Calcasieu Agricultural Credit Corporation, Lake Charles, La.
Central Discount Corporation, Eunice, La.
Northeast Louisiana Discount Company, Rayville, La.
Rice Growers Credit Corporation, Crowley, La.
Southwestern Louisiana Agricultural Credit Ass'n., Crowley, La.
Southwest Louisiana Livestock Loan Company, Lake Charles, La.
State Agricultural Credit Corporation, New Orleans, La.
Teche Agricultural Credit Association, Franklin, La.
Louisiana Agricultural Credit Corporation, Shreveport, La.

The geographic location of these organizations is shown in Figure III.

SUMMARY OF PERSONAL AND COLLATERAL LOANS

It has been pointed out that farmers use various sources for obtaining personal and collateral credit. The importance of these

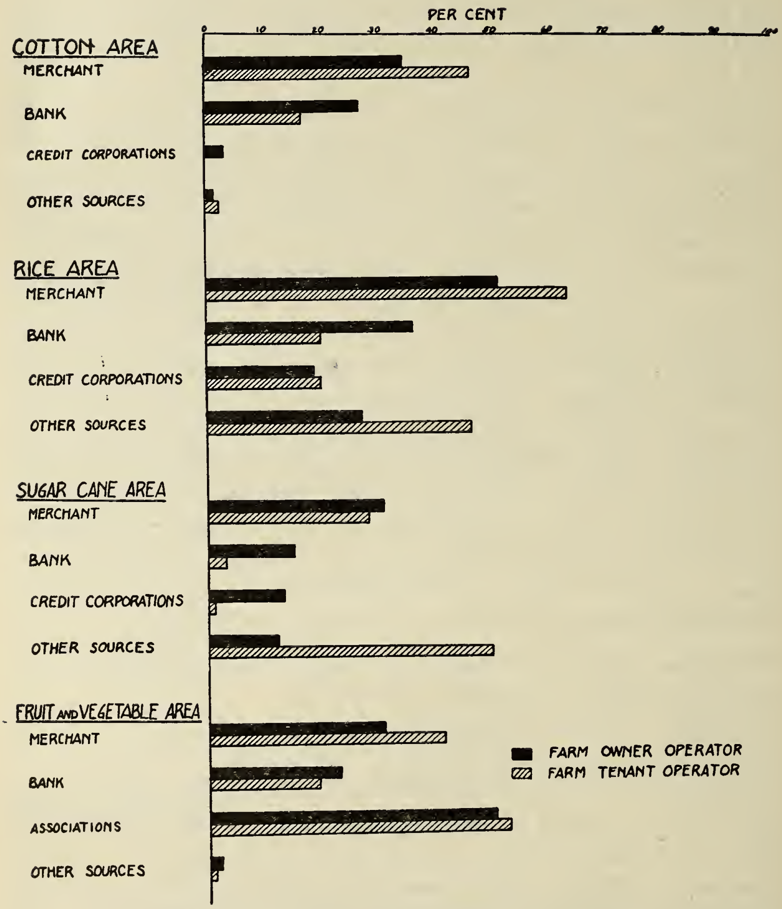

Fig. 4. Percentage of Farmers Using Personal and Collateral Loans and Sources of Credit in Four Farming Areas of Louisiana. 1928.

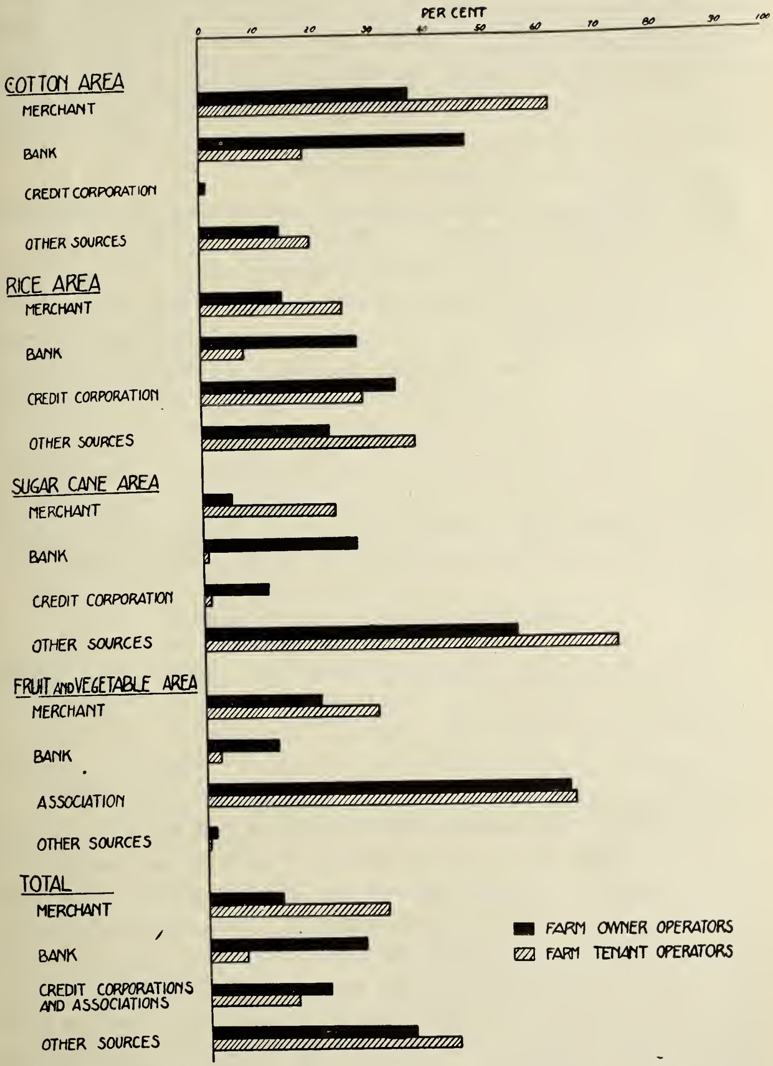

Fig. 5. Percentage Distribution of Amounts and Sources of Personal and Collateral Credit to Farmers in Four Farm Areas of Louisiana. 1928.

sources depends upon the type of farming. Figure 4 points out the per cent of farmers patronizing the different agencies in the various farming areas of the State. Merchant credit is used by a larger per cent of farmers in the cotton and rice sections while in the fruit and berry section the farm associations serve a greater number. In the sugar cane area, a greater number of farm owners depend on the merchant for credit but the tenants look to other sources, mainly the landlord.

The importance of these agencies with respect to amount of credit is indicated in Figure 5. Merchant credit stands out as an important source in the cotton area but gives way to bank and other sources in the rice, cane and trucking areas. The term of loans in the different areas is well timed with the needs of the farm groups. In those areas where nine to twelve months credit is needed, the agencies are supplying this term of loan and where credit for six months or less is required the loans conform to this requirement. The security for loans that is required by the different agencies in all areas vary between areas, and between agencies within the same area. Merchants, in all cases, apparently demand less security for the credit extended by them than do other credit agencies.

LONG TERM CREDIT IN LOUISIANA

What agencies are supplying long-term credit to Louisiana farmers? For what purposes are these loans made? What are the requirements for these loans? What is the relative importance of these agencies supplying this class of credit? These are some of the questions that are considered in this part of the discussion.

Long-term credit, as has already been suggested, is considered here as any loan made on the basis of a real estate mortgage as security with a maturity date of one year or more. The most important specialized long-term credit agency in the State is the Federal Land Bank, located at New Orleans. This bank serves the three states, Alabama, Mississippi and Louisiana, and has been in operation since 1917. Loans from this bank were made to Louisiana farmers through 80 national farm loan associations during 1928.

NATIONAL FARM LOAN ASSOCIATIONS

An examination of Figure 3, page 20, will show the territorial distribution of national farm loan associations in Louisiana.

In order to determine the loans made in different areas of the State, questionnaires were sent to the secretaries of these national farm loan associations. Forty-six were returned with the information requested. Table XXIII gives a distribution of these associations on the basis of loans made.

TABLE XXIII

NATIONAL FARM LOAN ASSOCIATIONS IN LOUISIANA CLASSIFIED ON THE BASIS OF LOANS CLOSED TO DECEMBER 31, 1928

Loans Closed	Number of Associations: Survey	Total*
$ 25,000 and less	2	9
25,000 to $ 50,000	4	......
50,000 to 100,000	3	10
100,000 to 150,000	5	10
150,000 to 200,000	5	......
200,000 to 250,000	3	14
250,000 to 500,000	11	18
500,000 to 750,000	3	5
750,000 to 1,000,000	3	4
1,000,000 to 2,000,000	6	9
2,000,000 and over	1	1
	46	80

The associations that reported give us a fair sample of the work that is being done in the different sections of the State. Fifty-seven per cent reported, and the number of borrowers in these associations represented 56.7 per cent of the total number and the loans reported by these units represented 59 per cent of the loans made in the State. The distribution of the associations reporting, according to territory seems to be approximately correct. The number reporting from the cotton area was 32, 6 from the rice area, and 5 and 3 from the cane, and fruit and vegetable areas respectively. With these data as a basis, the amount of loans for the different farming areas was estimated. Table XXIV gives these estimates by sections.

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*Twelfth Annual Report of the Federal Farm Loan Board, p. 118.

TABLE XXIV

PERCENTAGE DISTRIBUTION OF ESTIMATED LOANS MADE IN FOUR FARMING AREAS OF LOUISIANA BY THE FEDERAL FARM LOAN BANK WITH AVERAGE LOANS AND NUMBER OF BORROWERS, FROM ORGANIZATION TO DECEMBER 31, 1928

Area	Number of Associations	Per cent of Total Loans	Average Loan	Number Borrowers
Cotton	56	63.7	$2,071	$11,548
Rice	8	23.6	3,990	2,218
Sugar Cane	9	10.8	5,631	724
Fruit and Vegetable	7	1.9	1,120	637
†For State	80	100.0	$2,482	$15,127

By the end of 1928, 15,127 loans had been made aggregating 37,540,565 dollars. The cotton section of the State had utilized 63.7 per cent of these loans, rice farmers received 23.6 per cent, cane farmers, 10.8 per cent and truck farmers received 1.9 per cent of the total loans. The average loan per borrower was largest in the sugar section, being $5,631. The smallest average loans were made in the fruit and vegetable area, amounting to $1,120. Cotton and rice loans averaged $2,071 and $3,990 respectively.

Apparently farmers are asking for the largest amount of loans their property values will permit. Since the average value per farm in these areas in 1925 was given as $1,911 for cotton, $4,662 for rice farms, $5,843 for sugar cane farms, and $2,544 for fruit and vegetable farms. The maximum loan from this source can not exceed 50 per cent of the value of the land and 20 per cent of the value of improvements. Value of land and buildings for the different areas rank in about the same order which the loans rank. The fruit and vegetable farms have a little higher average value than do cotton farms.

The loan policies of the Federal Land Bank are the same throughout the State. In order to eliminate duplication the remainder of the discussion on Land Bank loans will deal with the State as a whole rather than with separate areas.

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†Twelfth report of the Federal Farm Loan Board, 1928, p. 117. The estimates were made on basis of this report and the survey data.

Table V, page 21 shows the growth of Federal Land Bank loans in Louisiana since the organization of the System. Table XXV which follows indicates the purpose of these loans.

TABLE XXV

PERCENTAGE DISTRIBUTION OF LAND BANK LOANS IN LOUISIANA ACCORDING TO PURPOSE FROM 1921 TO DECEMBER 31, 1928*

Year	Buy Land	Building and Equipment	Equipment, Fertilizer, Livestock and Irrigation	Pay Mortgages	Pay Other Debts	National Farm Loan Stock	Total
1921	13.0	17.0	9.0	47.0	9.0	5.0	100.0
1922	9.0	13.0	7.0	54.0	12.0	5.0	100.0
1923	6.0	11.0	6.0	59.0	13.0	5.0	100.0
1924	5.0	10.0	4.0	64.0	12.0	5.0	100.0
1925	5.0	10.0	4.0	64.0	12.0	5.0	100.0
1926	5.0	10.0	4.0	64.0	12.0	5.0	100.0
1927	5.0	10.0	4.0	65.0	11.0	5.0	100.0
1928	5.5	9.5	4.0	64.6	11.4	5.0	100.0

Approximately three-fourths of the loans since 1922 have been used to pay off past obligations either farm mortgages or other debts. The other one-fourth is fairly evenly divided between building and equipment, and other purposes. Five per cent of every loan is used to pay for stock in the local national farm loan association.

Farmers are fast taking advantage of the low interest rate and the long-term loans by converting the existing mortgage loans into the long-term loans with the Federal Land Bank. This, no doubt, has permitted a number of owner-operators to remain farm owners who otherwise would have become tenants, or who would have been forced out of the farming business, because without such facilities payments could not have been met on the old mortgages and the financing agencies would possibly have foreclosed in order to collect the debts.

The amount of land which had been mortgaged to the Land Bank by the end of 1928, amounted to 2,351,929 acres. This land was appraised at $76,921,344, and the total loans were $37,540,565 or 48.8 per cent of the appraised value of the lands. These appear to be conservative loans. However, as indicated in a preceding discussion, several of these farms have been foreclosed and excepting those that have been resold, are now held by the Federal Land Bank.

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*Annual Reports of the Federal Farm Loan Board, Nos. 5, 6, 7, 8, 9, 10, 11, 12.

The Federal Land Bank made some loans that were not based on sound values. When the system first started operations, the land appraisers were not as careful as they should have been and consequently, farmers "sold out to the bank." Other causes that have been suggested by bank officials and farmers as well for these bad loans are: manipulations on the part of the association officials to get larger loans than the property of the farmer permitted under ordinary conditions; the State road building program left some of the mortgaged farms in isolated places and values depreciated; death of owner; and adverse conditions of agriculture. On the whole, slight losses have been experienced by the Land Bank in these foreclosures.

JOINT-STOCK LAND BANK

Louisiana farmers have not used very much credit from the Joint-Stock Land Bank in New Orleans. Since 1923, the total loans have amounted to $1,429,200.† From 1924 to 1925 the increase in the volume of business with Louisiana farmers was 55.3 per cent. From 1925 to the end of 1928 the rate of increase has been less. The increase from 1927 to 1928 was 4 per cent.

The loans made by the Joint-Stock Land Bank cover an acreage of 70,022 in Louisiana with an appraisal value of $4,077,839, the ratio of the total loan to the value being 35 per cent. Assuming the same appraisal policy, this indicates that this institution is more conservative than the Federal Land Bank which is perhaps one of the reasons why the volume of business has been relatively small.

The purpose of the loans from the Joint-Stock Land Bank was primarily to pay off mortgages.

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†Annual Reports of the Federal Farm Loan Board, Nos. 7, 8, 9, 10, 11, 12.

TABLE XXVI

PERCENTAGE DISTRIBUTION OF LOANS MADE BY THE JOINT-STOCK LAND BANK TO LOUISIANA FARMERS ACCORDING TO PURPOSE. 1923-28*

Year	Buy Land	Building and Improvements	Equipment, Livestock, Fertilizer, Irrigation	Pay Mortgages	Other Debts	Total
1923	6.0	1.0	4.0	86.0	3.0	100.0
1924	6.0	1.0	4.0	86.0	3.0	100.0
1925	4.0	1.0	2.0	86.0	7.0	100.0
1926	3.0	......	2.0	88.0	7.0	100.0
1927	3.0	1.0	2.0	89.0	5.0	100.0
1928	3.3	.7	1.6	89.4	5.0	100.0

Approximately 90 per cent of the loans were used to pay off mortgages, where the next important purpose was to pay other debts. There is one striking feature about the purposes of loans for both Land Bank and Joint-Stock Land Bank, that is a relatively small proportion is used to buy land and put equipment on the farm. The outstanding advantage for loans from both banks no doubt has been to help farmers convert their short term loans to long term loans that could be paid out of the proceeds of the farms and help commercial banks get out of their portfolios a large amount of sound but temporarily frozen assets.

INSURANCE COMPANIES

Eleven insurance companies hold approximately 90 per cent of the estimated mortgage loans on Louisiana farms held by such companies. Out of 153 companies replying to a questionnaire sent to them, eleven held Louisiana farm mortgages. These companies had made 944 loans which amounted to $7,512,207. The ratio of loans to property value is 28 per cent. These loans run for a period from 5 to 20 years and are repayable in many ways. Two companies make their loans for a definite period and collect at the end of this period, two use the amortization plan, two companies permit loans to be paid in installments of 10 per cent, one leaves it to the borrower and the remainder did not report. The insurance companies have experienced very small losses on farm loans in the State. Only one company indicated a loss, and this was less than $2,500. Most of the companies seem to be looking elsewhere for fields of investment. Several indicated that they were getting out of farm loan business and placing their investments in a more liquid form. These officials reported that they felt that the long-term farm credit needs are being well cared for by the Federal Land Banks.

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*Reports of the Federal Farm Loan Board, Nos. 7, 8, 9, 10, 11, 12.

COMMERCIAL BANKS AS LONG-TERM CREDIT AGENCIES

Twenty-five out of the 26 banks reporting held farm mortgages in 1928. Their first mortgages amounted to $1,255,929 and their second mortgages were given at $72,553. There were 1,156 mortgage loans represented as first, and 41 as second mortgages. Only seven reported that they held second mortgages. If these banks are a representative sample of the banks of the State, it is possible to make a rather accurate estimate of the amount of mortgages that are held by the commercial banks of the State. The survey data from 26 banks indicated that their farm mortgage loans were equal to 5.14 per cent of the total resources of these banks. Assuming that this same ratio holds true for all state banks outside of New Orleans, the total mortgage loans outstanding in 1928 amounted to $11,375,610.†

Commercial bank loans on farm mortgages are made for periods ranging from three months to five years, the usual practice is to make the loan for a relatively short period and renew the loan from time to time, in order to give the borrower time to realize on the loan. The ratio of loans to value of property pledged, is 48.4 per cent. Bankers are well acquainted with conditions and the particular farm, thus it is expected that a larger proportion of the value can be loaned with safety, and, too, the local banker is likely to appraise the farm at a lower value than other agents.

The purposes of mortgage loans from commercial banks are: 23.5 per cent to pay off mortgages; 35.3 per cent to pay other debts; improvements 12.7 per cent; 13.8 per cent to buy land; 6.4 per cent to buy livestock; and the remainder for other purposes.

ACTIVITIES OF SAW-MILL COMPANIES IN SUPPLYING LAND CREDIT

Saw-mill companies and land companies are doing some work in encouraging farm ownership by selling cut-over lands on credit with long term payments. Only four of these companies returned questionnaires that were sent out. These four companies controlled 575,400 acres of land during 1928. They have sold approximately 200 farms within the past three years, ranging from forty acres to 100 acres per farm. The first payment required, varies from 10 to 25 per cent of the sale value of the land, and the balance is paid at some time in the future. Two of the companies give 5 years, one gives ten years in which to pay the balance and the other gives 20 years. This service is similar to services rendered by specialized loan agencies for the purpose of buying land.

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†Resources of State Banks outside of New Orleans at the Beginning of 1928 were $159,544,556; 5.14 per cent of this amount is $10,100,610—add to this $1,275,000, the amount reported by the comptroller‡ for National Banks and the total equals $11,375,610.

‡Report of Comptroller of Currency, 1928—June 30, p. 30.

SECTION IV.

COST OF CREDIT ON LOUISIANA FARM LOANS

Credit costs include such items as interest, commission charges, carrying charges, difference between cash and credit prices on commodities, and various other expenditures. Commission charges are exacted by banks as extra pay for the services rendered in making the loan. Carrying charges are usually made by merchants. This is usually referred to by merchants as an interest charge, but the time element is ignored and it becomes an extra charge for credit privileges. In addition to the carrying charge, many merchants add to the cash price an extra charge to arrive at a credit price. This is ordinarily called a discount for cash by the merchant. This is a misnomer however, because the list price is the cash price in most instances and the credit price is fixed on the basis of the cash price. This difference however, between a cash and a credit price will be called a discount in the discussion following.

The first phase of the discussion deals with the variation in credit costs in different areas of the State, as was indicated by farmers who were included in the survey. These farmers listed their short-term credits and indicated the prices that were paid for these loans. These data are tabulated in Table XXVII for the different farm areas.

TABLE XXVII

AMOUNT OF CREDIT AND RATE OF INTEREST CHARGED FOR PERSONAL AND COLLATERAL LOANS IN FOUR AREAS OF LOUISIANA, SURVEY 1928

Area	Total Amount of Personal and Collateral Credit Reported	Average Rate of Interest
Cotton	$ 187,834	10.9
Rice	306,633	7.7
Sugar Cane	637,768	8.0
Fruit and Vegetable	126,620	9.6
Total	$1,251,867	8.5

Before attempting to account for these differences, it will be necessary to find out the sources of this credit and the charges made at each source. This information is given in Tables XXVIII and XXIX.

TABLE XXVIII

PERCENTAGE DISTRIBUTION OF PERSONAL AND COLLATERAL LOANS TO FARMERS IN LOUISIANA—SOURCES AND INTEREST RATES, SURVEY 1928

Sources	Number Men Using Credit	Per Cent of Total Credit	Interest Rate	Interest Plus Discount
		Cotton Area		
Merchant	48.3	42.6	9.7	14.2
Bank	29.6	41.0	8.6	....
Credit Corp.	.3	15.5	8.0	....
Other Sources	1.9	.9	no report	
Total	368	$187,834	......	....
		Rice Area		
Merchant	67.9	16.5	7.1	8.97
Bank	38.8	24.2	7.9	....
Credit Corp.	24.3	33.8	7.8	....
Other Sources	40.8	25.5	7.2	....
Total	103	$306,633	......	....
		Sugar Cane Area		
Merchant	37.1	7.5	8.2	9.40
Bank	9.8	23.9	7.9	....
Credit Corp.	8.7	10.6	7.4	....
Other Sources	37.2	58.0	8.0	....
Total	183	$637,768	......	....

TABLE XXVIII—*Continued.*

Sources	Number Men Using Credit	Per Cent of Total Credit	Interest Rate	Interest Plus Discount
	Fruit and Vegetable Area			
Merchant	41.9	22.2	7.8	17.9
Bank	27.7	11.3	8.0	....
Association	76.8	65.0	7.6	....
Other Sources	1.2	1.5	no report	
Total	155	$126,620	.....	....

TABLE XXIX

INTEREST AND OTHER CHARGES FOR CREDIT BY DIFFERENT AGENCIES IN FOUR FARMING AREAS OF LOUISIANA

Area	Merchant	Bank	Credit Corp. and Association	Other Sources	Total
Cotton	14.2	8.6	8.0	.....	$ 187,834
Rice	9.0	7.9	7.8	7.2	306,633
Cane	9.4	7.9	7.4	7.9	637,768
Fruit and Vegetable	18.0	8.0	7.6	.....	126,620
Amount Credit	$206,168	$317,741	$255,434	$479,503	$1,258,855

If we follow the data through in Tables XXVIII and XXIX, it will be evident why the credit charges in the cotton, and fruit and vegetable areas are higher than in the other areas. The rate of interest on merchant credit is proportionately larger in the cotton, and fruit and vegetable areas being 14.2 and 18 per cent respectively. The so-called discounts for cash are included in the merchants' charges.

Rice and sugar cane farmers seem to have the advantage over other farmers with respect to charges for credit. It will be noted in Table XXVIII that these farmers tend to diversify their credits more in these two areas, that is, divide their business among the different agencies, than is true in the other areas. This brings about competition between the agencies and results to a certain extent in an equalization of interest rates.

In the fruit and vegetable area, a greater proportion of farmers are using that source of credit which costs them least. This is not true in other areas. The sugar cane people use merchant credit to the extent of 37 per cent of their total short-term credits and pay on an average of 9.4 per cent when there are available sources that charge 7.4 per cent. In the cotton area, 48.3 per cent of the farmers obtain 42.6 per cent of the short-term credit from merchants and pay an average of 14.2 per cent, while others in the same area get credit for 8 per cent. It is possible that these lower rates cannot be had by a large number of farmers in these areas due to their credit rating, thus leaving only the higher priced service available for them.

Why farmers continue to use the high priced service is a question that is difficult to answer. There are several reasons that may be advanced, and these are based on statements from farmers in different sections of the State: (1) "The merchant is the only agency that will give me credit"; (2) "The merchant is convenient and we are willing to pay a little higher price for this form of service"; and (3) "Banks insist upon debts being paid when they are due regardless of the ability to pay, while merchants will give more time and continue to supply the credit until conditions are such that bills can be paid". It is believed that a number of farmers are not aware of the fact that such differences exist between agencies, thus they have not made an effort to find the most economical sources of credit.

Should the additional value received from merchants, in the form of "convenience", "ease of mind" and other psychological values be disregarded, it is possible for farmers of the State, where they have a choice, to borrow money from specialized credit agencies and pay cash for merchant services and goods, thereby making a considerable saving according to survey data. When interest and discounts are combined the total charge on merchant credit is $9,431 on $67,752 of business that carried these extra charges. Forty-seven per cent of the farmers obtained credit from merchants, 6.6 per cent obtained merchant credit without paying an interest rate or being given the privilege of a discount for cash. This leaves 40.5 per cent of all farmers, who do a merchant credit business, to pay the excessive charges. If this reasoning be applied to all farmers of the State, (croppers excluded), the annual savings that could be made by using bank credit at 8 per cent and paying cash to merchants is approximately three-quarters of a million dollars. The estimated amount of business done in the State under the above conditions is $8,247,294, which costs the farm group $1,145,457 annually. The same amount at 8 per cent for nine months, the prevailing period of merchant credit, would cost $494,838. The difference is worth considering by those who are able to select their credit sources.

Averages serve to give a picture of what is happening in a territory but they do not tell the story of what interest rate is being charged by the different agencies in the farming areas of the State. Tables XXX and XXXI give the percentage of credit used by farmers at different rates of interest.

The amount of interest charged on loans and accounts range from 3 per cent to 20 per cent, as indicated by Tables XXX and XXXI. Merchants do a rather large amount of business on which they make no direct charges in the form of interest or carrying

TABLE XXX

PER CENT OF CREDIT FROM DIFFERENT SOURCES FOR VARIOUS RATES OF INTEREST. LOUISIANA 1928

Owner-Operators—Cotton Area

Interest Rates	Merchant	Bank	Credit Associations	Other Sources
0	30.4	....	....	....
6	.3	2.2	....	....
8	32.5	75.0	100.0	....
9	....	2.9	....	....
10	33.0	7.0	....	....
12	....	12.9	....	....
12½	.4	....	....	....
15	1.4	....	....	....
20	.9	....	....	....
Not Reported	1.1	....	....	100.0
Total amount of credit	55,283	69,837	1,250	21,303

Rice Area

Interest Rates	Merchant	Bank	Credit Associations	Other Sources
0	76.1	....	....	....
5½	....	....	....	12.9
6	19.7	....	....	....
7	....	8.7	....	....
7½	....	....	97.2	....
8	11.5	89.8	2.8	9.6
9	....	1.5	....	....
10	1.7	....	....	....
20	1.0	....	....	....
Not Reported	....	....	....	77.5
Total amount of credit	36,633	69,925	87,800	54,454

TABLE XXX—Continued

Interest Rates	Merchant	Bank	Credit Associations	Other Sources
	Sugar Cane Area			
0	19.5	....	....	....
4	2.3	....	....	....
5	.7	....	....	....
6	....	....	7.5	....
6½	....	....	1.1	....
7	.7	2.0	....	....
7½	....	23.1	69.0	11.2
8	73.1	74.9	2.4	78.2
10	....	....	....	.3
15	1.0	....	....	....
Not Reported	2.7	....	....	10.3
Total amount of credit	29,268	151,194	66,579	313,459
	Fruit and Vegetable Area			
0	15.3	....	....	....
3	4.3	....	....	....
5	3.6	....	.5	....
6	3.2	....	22.1	....
8	65.9	100.0	73.9	....
10	7.7	....	3.5	....
Not Reported	....	....	....	100.0
Total amount of credit	22,003	13,763	68,425	1,675

TABLE XXXI

PER CENT OF CREDIT FROM DIFFERENT SOURCES FOR VARIOUS RATES OF INTEREST. LOUISIANA 1928

Tenant-Operators—Cotton Area

Interest Rates	Merchant	Bank	Credit Associations	Other Sources
0	16.2	....	....	....
1	1.5	....	....	....
8	15.3	91.5	....	....
9	2.5	....	....	....
10	50.2	7.8	....	....
12	....	.7	....	....
12½	1.5	....	....	....
15	7.5	....	....	....
20	5.3	....	....	....
Not Reported	....	....	....	100.0
Total amount of credit	24,649	7,210	0	7,902

TABLE XXXI—*Continued.*

Interest Rates	Merchant	Bank	Credit Associations	Other Sources
	Rice Area			
0	66.9	....	....	....
6	18.1	....	....	....
7	....	....	12.6	....
7½	....	....	87.4	....
8	8.7	100.0	....	36.7
10	4.0	....	....	....
12½	2.3	....	....	....
Not Reported	....	....	....	63.3
Total amount of credit	13,791	4,275	15,900	20,980
	Sugar Cane Area			
0	12.0	....	....	5.4
7½	....	....	100.0	....
8	79.4	100.0	....	88.9
10	....	....	....	1.5
15	7.9	....	....	....
Not Reported	.7	....	....	4.2
Total amount of credit	18,494	936	1,158	57,551
	Fruit and Vegetable Area			
0	6.4	....	3.7	....
5	....	....	3.1	....
6	....	....	14.0	....
8	54.7	100.0	77.2	....
10	1.8	....	2.0	....
Not Reported	37.1	....	....	100.0
Total amount of credit	6,047	600	12,629	185

charge. However, it is the merchant group that makes the extra high charges. The prevailing rate charged by all agencies is 8 per cent, this being the legal rate.* Banks in some cases charge as high as 12 per cent, other agencies charge 10 per cent as a maximum, and credit corporations use 8 per cent as their maximum interest charge. There is no marked difference in the charges made to tenants and those made to owner-operators. A slightly greater proportion of tenant business bears a 15 and 20 per cent rate with merchants. It is expected that merchants charge a higher rate than other agencies because they extend credit to individuals who do not have security to offer and they assume a great risk in doing so. The greater risks are off-set by the higher charge.

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*The legal rate of interest in Louisiana is 8 per cent for ordinary loans. A law has been passed recently legalizing 3½ per cent per month. on what are called industrial loans.

Schedules returned by merchants substantiate the data received from farmers on interest charges. Merchants indicated that their interest charges ranged from no charge to 20 per cent and that the discount ranged from 0 to 10 per cent, the prevailing rate being 10 per cent. Bank records also checked very closely with farm records. Banks reported that approximately 75 per cent of their personal and collateral loans were made at 8 per cent interest, 12 per cent of their loans at an interest rate of 12 per cent, and only 2 per cent were for 6 per cent interest or less.

Interest rates on personal and collateral loans from banks to farmers do not vary very much over a period of years. In 1921, Valgren found that the interest rate used by local banks in Louisiana for farm loans ranged from 8 to 10 per cent.† On 75.5 per cent of the loans 8 per cent interest was paid, a rate of 9 per cent was paid on 8.2 per cent of the loans and a rate of 10 per cent was paid on 14.3 per cent of the loans. This study also indicated that 94 per cent of the banks in Louisiana collected interest in advance. The advance interest collection applied to 72.4 per cent of the total loans of this class, which were made to farmers.‡ Thus a loan of a $100 that pays 8 per cent interest if collected in advance, amounts to an interest rate of approximately 8.7 per cent. In addition to the advance interest collection, 16 per cent of the banks required borrowers to maintain a bank balance of at least 14 per cent of the loans.§ When these two items are taken into consideration, loans from banks cost farmers more than the stated interest rate indicates.

According to information received from bankers and farmers, banks in the rice and cane areas, more than banks in the other areas, collect interest in advance and require a bank balance during the period of the loan. This practice, though not true with all banks of the areas, tends to off-set the apparent advantage of a lower interest rate paid on bank loans in these two areas over that paid in the cotton, and fruit and vegetable areas.

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†Valgren, V. N., and Englebert, E. E., Bank Loans to Farmers on Personal and Collateral Security, 1922, p. 18.

‡Valgren, V. N., and Englebert, E. E., Bank Loans to Farmers on Personal and Collateral Security, p. 19.

§Valgren, V. N. and Englebert, E. E., Bank Loans to Farmers on Personal and Collateral Security, 1922, p. 18.

INTEREST RATES ON LONG-TERM LOANS

Of the 535 farm owners interviewed, 34.5 per cent reported that they had obtained loans on first mortgage security, and 6.7 per cent reported second mortgage loans. The first mortgages are distributed over the four areas as follows: 22.6 per cent in the rice area; 23.1 per cent in the sugar cane area; 41.9 per cent in the cotton area; and 12.4 per cent in the fruit and vegetable area. There were no second mortgages reported in the fruit and vegetable area, but those reported by farmers in the other areas were distributed on the basis of percentage of farmers with second mortgages as 3.6 per cent in the cotton area, 13.5 per cent in the cane area and 22.7 per cent in the rice area. The interest rates paid on these mortgage loans are shown in Tables XXXII and XXXIII.

TABLE XXXII

PERCENTAGE DISTRIBUTION OF FIRST MORTGAGE LOANS ON LOUISIANA FARMS IN FOUR FARMING AREAS ON THE BASIS OF INTEREST RATES CHARGED, SURVEY 1928.

	Interest Rates								
Area	3½	4½	5	5½	6	6½	7	8	Amount
Cotton	.7	1.2	6.2	23.2	28.4	....	1.1	39.2	$266,638
Rice	....	....	1.4	69.9	......	5.9	18.6	4.2	308,740
Sugar Cane	....	....	5.2	7.0	11.0	5.2	31.5	40.1	357,892
Fruit and Vegetable	....	....	29.3	......	23.2	....	9.6	37.9	17,174

TABLE XXXIII

PERCENTAGE DISTRIBUTION OF SECOND MORTGAGE LOANS ON LOUISIANA FARMS IN THREE FARMING AREAS ON BASIS OF INTEREST RATES CHARGED, SURVEY 1928

	Interest Rates						
Area	5	6	6½	7	7½	8	Total Amount
Cotton	......	20.0	....	......	......	80.0	$ 10,750
Rice	11.8	7.9	7.9	23.6	29.5	19.3	127,132
Sugar Cane	2.1	7.1	....	......	......	90.8	44,976
Fruit and Vegetable	......	......	....	......	......	......	....

That there is a wide variation in the interest rates paid on first mortgage farm loans in Louisiana is indicated by data found in Table XXXVI. In the cotton area the rate ranges from 3½ per cent to 8 per cent, with an average rate of 6.6 per cent. With the exception of the small amount at 3½ to 4½ per cent, the low rates have been on Federal Land Bank loans. Most of the 8 per cent money is obtained from local banks, and individuals. The average rates in the rice, sugar cane, and fruit and vegetable areas, are

5.9, 6.6, and 6.6 respectively. This average is practically the same throughout the State and leads us to conclude that interest rates on long-term loans have been equalized, over the four areas, the average for all being 6.4 per cent.

The percentage distribution of second mortgage loans on the basis of interest rates paid is indicated in Table XXXVII. The average rate, based on these data, for the cotton belt is 7.6 per cent, for the rice area, it is 7 per cent, and for the sugar cane area, it is 7.8 per cent. This gives an average rate for the three areas of 7.2 per cent on second mortgage loans.

The difference between first and second mortgage rates in the State, based on the above data, is .8 per cent. This corresponds very closely to the difference found by Valgren in 1921, his figure being .87 per cent.* This report indicated that the high and low interest rates were 8.63 and 7.73 per cent; since 1920, the average has decreased to 6.4 per cent for the State. This decline in the average rate has been brought about to a great extent by the activities of the Federal Land Bank. This bank had made loans to Louisiana farmers to the amount of $7,280,465† by the end of 1920, and by December, 1928, its total loans to Louisiana farmers were $37,540,565.‡ Most of these loans have been made for 5 and 5½ per cent. This would bring down the average rate for the State even though other rates remained where they were in 1920.

Interest rates as reported by twenty-six commercial banks varied very little from 8 per cent, in 1928. These reports did not show any marked variation between rates charged on first and second mortgage loans. Louisiana laws provide for a maximum interest rate of 8 per cent and this fact probably caused some bias in the reports from banks. There were a few bankers who reported interest rates as high as 10 per cent, and some reported 7 per cent but the prevailing rate was given as 8 per cent.

INTEREST RATES ON INSURANCE COMPANY LOANS

Data are not available for insurance company loans to farmers in different areas of the State, but from schedules returned by companies operating in Louisiana, we have information on interest rates paid on this class of loans for the entire State. Of the

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*Valgren, V. N. and Englebert, E. E., Farm Mortgage Loans by Banks, Insurance Companies and other Agencies, Bul. 1047, p. 15.

†Fifth Report of the Federal Farm Loan Board, p. 12.

‡Twelfth Report of the Federal Farm Loan Board, p. 117.

$7,503,287 loans reported, 62.8 per cent of this amount was bearing a rate from 5.5 to 5.99 per cent; 12.1 per cent was bearing a rate from 6 to 6.99 per cent; and the balance was bearing 7 per cent; $8,920 was not reported. The average rate for the entire amount of loans is 6.15 per cent. This is .25 of one per cent less than the average rate on first mortgage loans for the State.

INTEREST RATES ON FEDERAL LAND BANK AND THE FIRST JOINT-STOCK LAND BANK LOANS

Maximum interest rates on loans made by the Federal Land Bank and the First Joint-Stock Land Bank are determined by law. The rate for the Federal Land Bank cannot exceed 6 per cent. The rate charged is determined by the rate that is borne by the last bond issue of this institution. If the bonds bear an interest rate of 4½ per cent, the interest rate on loans cannot exceed 5½ per cent. The bond rate plus one per cent equals the maximum rate that can be charged at that time. The Joint-Stock Land Bank is regulated in the same way, except that it does not have the maximum rate of 6 per cent determined.

Farmers, receiving loans from the Federal Land Bank through the national farm loan associations, find that there are costs involved other than the interest rate. The most important cost item is preliminary to securing the loan. Every farmer seeking a loan must furnish a guaranteed title to the land on which he wishes to give a mortgage as security for the loan. The cost of obtaining an abstract of title varies for different areas and also varies greatly between individual farms. This cost is shown in Table XXXIV.

TABLE XXXIV

AVERAGE COST OF OBTAINING ABSTRACTS TO TITLE ON LOUISIANA FARMS IN FOUR FARMING AREAS AND PER CENT THIS COST IS OF LOAN. SURVEY, 1928

Area	Average Cost Per Farm	Per Cent Abstract Cost of Average Loan
Cotton	$17.00	.8
Rice	24.00	.6
Sugar Cane	21.00	.4
Fruit and Vegetable	12.00	1.1

The data in Table XXXIV are based on estimates made by the Secretary-Treasurers of forty-six national farm loan associations in the State. There is no general agency that serves the farmer in this respect. Attorneys are accepted who make their charges for this service comparatively high. Some of the secretary-treasurers reported charges of 50 dollars per farm for an entire district, others reported an average of less than ten dollars for the district. With this wide variation in charges, it appears that some are too high. A distribution of charges for abstracts is given in Table XXXV.

TABLE XXXV
FREQUENCY DISTRIBUTION OF AVERAGE COSTS FOR OBTAINING ABSTRACTS ON LOUISIANA FARMS

Cost per Farm	Number of Associations
\$ 5.00 to \$ 9.00	2
10.00 to 14.00	8
15.00 to 19.00	5
20.00 to 24.00	7
25.00 to 29.00	11
30.00 to 34.00	2
35.00 to 39.00	2
40.00 to 44.00	2
45.00 to 49.00	1
50.00 to 54.00	4

The average charge for abstract work in the state is \$18.35 per farm, which is equal to .7 of one per cent of the average loan in the State from the national farm loan associations. The four associations indicating high charges for abstract service are widely separated and they include 7.1 per cent of the borrowers in the 46 associations and they involve 12.5 per cent of the total loans of these institutions. In addition to this charge, every applicant pays five per cent of the amount loaned for stock in the national farm loan association. This is not a cost but an investment. For the man who needs the additional 5 per cent it becomes a cost to him for the time. Of the total number of national farm loan associations reporting, 80.4 per cent charged 1 per cent which is permitted for administration work. Two reported that there were no charges made for this purpose, and the remainder indicated that they charged one-half of one per cent for administration purposes. When the entire costs are brought together the sum is less than the interest charged by local banks and as low as any other lending agency in the State except a small number of individuals who lend at 3½ to 4½ per cent interest.

TABLE XXXVI

AMOUNT OF LOANS AND THE AVERAGE INTEREST RATES CHARGED BY DIFFERENT AGENCIES ON FARM MORTGAGE LOANS IN LOUISIANA, 1928

Agency	Mortgage Debt Outstanding	Farm Survey Per Cent	As Reported by Institutions Per Cent	Range Per Cent
Commercial Banks	$11,375,610*	7.3	8.4	5-8
Insurance Companies	9,021,000*	6.0	6.1	5½-7
Federal Land Bank	29,220,000	5.8	5.0†	5-6
Joint-Stock Land Bank	1,160,000	6.0	5½.6‡	5½-6

The data found in Table XXXVI give a comparison of the relative importance of the different long-time lending institutions as to amount as well as the interest rate charged. Amounts from the Federal Land Bank and the Joint-Stock Land Bank are given in round numbers and are based on actual reports, while the amounts from commercial banks and insurance companies are estimates as already indicated. The interest rates are fairly representative as is noted when comparing the rates from the different sources. These rates do not necessarily represent the interest rate for 1928, except for those rates given from the reports, but represent rates that have been charged over a period of time. Some of the loans included in the table were made several years ago, and this accounts in part for the relatively wide range in rates indicated in the last column of the table.

The rate charged by the Federal Land Bank was 5½ per cent during the years of 1918, 1919, and 1920. It went to 6 per cent in 1921 and in 1922 it moved back to 5½ per cent to remain there until 1926. For the past two years, it has been at 5 per cent. Interest rates charged by the Joint-Stock Land Bank have ranged from 5¼ per cent to 6 per cent, since 1923.

The volume of business which is indicated in Table XXXVI shows that Louisiana farmers are selecting agencies that can supply their long-term credit needs at low rates of interest. There is still an opportunity for savings to be made by shifting some of the longer term loans which bear a high interest rate to agencies that maintain a low rate.

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†Report of the Federal Farm Loan Board, 1928, p. 123.
‡Report of the Federal Farm Loan Board, 1928, p. 123.
*Estimated.

(Note) Individual loans represented 5.4 per cent of the mortgage loans reported by farmers, and the average rate of interest was 7.5%.

SECTION V.

FARM MORTGAGE CREDIT AND ITS RELATION TO LAND TENURE

One of the purposes of credit legislation in this country has been to help farmers become owners of the land which they cultivate. This purpose has been realized in that institutions have been established throughout the country which extend credit to farmers and prospective farmers with which to buy lands and equipment. These institutions have been used by farmers and at the present time credit agencies hold a rather large equity in the farm lands of the country. Louisiana has experienced a gradual growth in the amount of mortgage debt on the farms of the state since 1890. Has this increase in the mortgage debt brought about a greater number of farm owner-operators in the state, or has it helped to maintain a system of absentee-landlordism and tenant farming? The following discussion relates to this question.

Farmers come into possession of land either through a system of ownership or a system of tenancy. Ownership may be acquired through inheritance, cash purchase, homesteading, or through some system of credit. The most common system used is the farm mortgage, or a combination of the cash and credit system. The common forms of tenantry through which Louisiana farmers come into temporary possession of farm lands are; the cash system, where a certain number of dollars per acre is paid as rental; the cropper system, where the tenant supplies the labor only and receives half the crop while the landlord furnishes land and capital; and the share system, where a part of the crop, as a third or a fourth, is given for the use of the land. We will discuss the mortgage situation first, the data for which were obtained from the Census volumes and a survey made in Louisiana in 1928.

An examination of Table XXXVII will indicate some of the changes that have taken place with respect to mortgage credit in Louisiana since 1890.

TABLE XXXVII

NUMBER OF FARMS, ACRES IN FARMS, PER CENT OF FARMS MORTGAGED AND PER CENT MORTGAGE DEBT IS OF TOTAL VALUE, LOUISIANA, 1890-1925†

Year	Number of Farms	Acres in Farms	Per Cent Farms Mortgaged	Per Cent Farm Debt is of Value of Farm
1890	79,705	3,774,688	3.9	44.1
1900	115,969	4,666,532	16.6	.........*
1910	120,549	10,439,481	18.6	31.0
1920	135,463	10,019,822	20.6	30.0
1925	132,450	8,837,502	27.5	42.9

There was a marked increase in the number of farms from 1890 to 1920, but the number decreased during the period from 1920 to 1925. The number of acres in farms increased rapidly to 1910, reaching a maximum acreage of 10,439,481, then decreased to 8,837,502 acres by 1925. This change in the number of farms and the number of acres in farms has resulted in a smaller size farm unit. In 1890 the average size of farms in Louisiana was 373.5 acres, and in 1925 it was 66.7 acres.

It is not possible to say whether or not the credit situation played a part in the reduction of the size of farm. There are probably several factors that have contributed to this change. In the first place refrigeration systems made it possible for a large number of small fruit and vegetable farms to develop since distant markets were made available for their products. Again, periods of depression in agriculture seem to have caused a breaking down of the plantation system in some areas of the State, and the growth of urban centers has given rise to thousands of small farms in the near-by areas which supply fresh vegetables and live-stock products for the urban population.

This change in the physical unit has been accompanied by a steady increase in the per cent of farms mortgaged, increasing from 3.9 per cent in 1890 to 27.5 per cent in 1925. Column five in Table XLI shows how the debt value ratio has changed since 1890. Of the total value of farms mortgaged in 1890, 44.1 per cent was mortgaged. This decreased to 30 per cent by 1920 and increased to 42.9 per cent by 1925. The debt value ratio does not necessarily measure the activities of farm borrowings. Mortgages are outstanding for long periods and any important change in the general price level is reflected in land values. Mortgages that were made prior to 1916 were based on relatively low land values. These same mortgages represented in 1920 a much smaller percentage of farm values than they did in 1916. The same is true for mortgages made from 1917 to 1920, if the debt-value ratio be determined in 1925, except that the movement was in the opposite direction. The downward swing in land values since 1920 together with an increase in size of mortgages have caused the debt value ratio to increase.

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†U. S. Census, Farm and Homes, 1890 - 1900, 1910, 1920. Vol. V. Census of Agriculture, 1925, Part II.

*Data not available.

This increase in the percentage of encumbered farms has not been accompanied by a corresponding increase in the number of farm owner-operators. We have already seen that the number of farms has decreased within the past few years. The amount of tenancy has been on the increase during this period. In 1890 there were 55.5 per cent of the farms in Louisiana operated by tenants, and in 1925, the percentage had increased to 60.1.

Less than 6 per cent of the mortgage loans that have been made in recent years were used to purchase land, while in 1890, 31.98 per cent were used for this purpose.*

The average value per mortgaged farm, the average debt per mortgaged farm and the owner's equity are indicated in Table XXXVIII. A per acre basis would serve better for comparative purposes but due to lapses in the Census materials it is necessary to work on a per farm basis. The size of the farm mortgage has a tendency to increase with the value of farms. For 1920, the land values moved up just preceding this date and the amount of mortgage had not had time to make the ordinary adjustments.

TABLE XXXVIII

AVERAGE VALUE OF ENCUMBERED FARMS IN LOUISIANA, AVERAGE AMOUNT OF ENCUMBRANCE AND OWNERS EQUITY, 1890 TO 1925†

Year	Average Value per Encumbered Farm	Amount of Mortgage Debt per Farm	Owners Equity Per Cent
1890	$5,423.00	$2,392.00	55.9
1910	3,826.00	1,190.00	68.9
1920	6,636.00	1,989.00	70.0
1925	5,446.00	2,336.00	57.1

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*U. S. Census, Farm and Homes, p. 540, 1890.

†U. S. Census 1890, Farm and Homes, p. 395, Vol. VI. 1910, p. 684, 1920, p. 614, Part 2. Census of Agriculture, 1925, Part II, p. 989.

TABLE XXXIX

PERCENTAGE CHANGE IN VALUE OF MORTGAGED FARMS, AMOUNT OF MORTGAGE DEBT, AND FARMERS EQUITY, LOUISIANA, 1910 TO 1925. (Based on Census Data)

Year	Change in Total Value of Mortgaged Farm Per Cent	Change in Amount of Mortgage Debt Per Cent	Change in Farmers' Equity Per Cent
1910	273.6	163.5	23.2
1920	137.6	128.9	1.6
1925	–32.2	47.7	–18.4

Marked changes have taken place in the value of mortgaged farm lands since 1890. During the twenty years prior to 1910, the value of mortgaged farms increased 273.6 per cent. From 1910 to 1920, these values increased but at a slower rate, the gain being 137.6 per cent. There was an absolute decrease of 32.2 per cent from 1920 to 1925. The percentage change in mortgage debt has been almost as great, while the change in farmers equity has been relatively small showing a loss from 1920 to 1925 of 18.4 per cent. These changes are shown in Table XXXIX.

It has already been indicated that farm tenancy has been increasing along with the increase in number of farm mortgages in Louisiana. This increase is not altogether due to a lack of credit facilities. A relatively large number of farmers in the State do not desire to become farm owners. The negro, as a rule, prefers to be supervised by the more intelligent farm owner, and some white farmers prefer to be free from the responsibilities of farm ownership. They prefer the life of a tenant to that of a burdened farm owner, according to the statements made by them. The tenant situation in the State is shown in Table XL.

TABLE XL

NUMBER OF FARMS, PER CENT OF FARMS, PER CENT OF ACREAGE AND PER CENT OF FARM VALUES OPERATED BY TENANTS IN LOUISIANA, 1890 TO 1925*

Year	Number of Farms Operated by Tenants	Per Cent of Farms Operated by Tenants	Per Cent of Land Operated by Tenants	Per Cent Value of Farms Operated by Tenants
1890	30,755	44.4	....	....
1900	67,234	58.0	26.4	29.7
1910	66,607	55.3	25.7	31.0
1920	77,381	57.1	28.6	35.5
1925	79,561	60.1	29.7	35.7

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*U. S. Census, 1910, Vol. VI., p. 666; 1920, Vol. V, p. 140-162-147, Census of Agriculture, 1925, Part II, p. 981.

It will be noted that not one state was entered in both groups in Table XLI. Only one state in Group II had as high per cent farms mortgaged as the lowest per cent of farms mortgaged in Group I and only four states in Group I had as high per cent tenancy as the lowest per cent tenancy in Group II.

A similar comparison can be made by examining Table XLII for the ten parishes that have the highest per cent of farms mortgaged and the ten that have the highest per cent farm tenancy.

TABLE XLII

PER CENT OF TENANCY AND PER CENT OF FARMS MORTGAGED IN TEN PARISHES WITH 40 PER CENT MORTGAGES OR ABOVE AND TEN WITH 70 PER CENT TENANCY OR ABOVE. LOUISIANA, 1925*

Parish	Per Cent Farm Mortgage	Per Cent Farm Tenancy
	Group I	
West Carroll	55.3	70.5
Franklin	54.2	78.8
St. Mary	47.0	42.7
Jeff. Davis	46.3	59.2
Richland	45.8	83.0
Tensas	43.8	94.5
Vermilion	43.1	48.8
East Carroll	42.2	91.9
Concordia	40.8	90.7
Iberville	40.0	47.7
	Group II	
Madison	29.9	95.3
Tensas	43.8	94.5
East Carroll	42.2	91.9
Concordia	40.8	90.7
Caddo	15.0	84.4
Richland	45.8	83.0
Morehouse	31.8	80.3
Red River	37.5	80.1
Franklin	54.2	78.4
Bossier	15.4	76.1

When studying the relationship between farm mortgage and farm tenancy in the parishes of the State, it will be seen (Table

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*Census of Agriculture 1925, Part II, p. 981-997.

The relationship between the number of farms mortgaged and the per cent of tenancy for the parishes within the State of Louisiana is not the same as the relationship between these two factors within the agricultural states of the United States. If we take ten states with the per cent of mortgaged farms 40 or above and compare these with ten states with the per cent of tenancy 40 or above, this comparison will show that the states with high percentage of mortgaged farms tend to have a low percentage of tenancy and those with high tenancy have a relatively low percentage of mortgages. There are many factors that enter to determine the per cent tenancy and the per cent mortgages in any state, however, this relationship tends to hold true. A comparison of these twenty states is made in Table XLI.

TABLE XLI

PER CENT OF TENANCY AND PER CENT OF MORTGAGES ON FARMS FOR TEN STATES WITH 40 PER CENT OF MORTGAGES OR ABOVE, AND TEN STATES WITH THE PER CENT OF TENANCY 40 PER CENT OR ABOVE, 1925†

States	Per Cent Mortgage	Per Cent Tenancy
	Group I	
South Dakota	62.4	41.5
North Dakota	63.8	34.4
Nebraska	56.5	46.4
Wisconsin	55.9	15.5
Iowa	55.6	44.7
Montana	54.6	21.9
Idaho	54.6	24.4
Colorado	53.1	30.9
Minnesota	48.6	27.1
Kansas	46.5	42.2
	Group II	
Mississippi	33.1	68.3
S. Carolina	25.9	65.1
Georgia	27.2	63.8
Alabama	29.9	60.7
Texas	33.9	60.4
Louisiana	27.5	60.1
Oklahoma	48.3	58.6
Arkansas	32.9	56.7
N. Carolina	19.3	45.2
Tennessee	20.7	41.0

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†Census of Agriculture 1925, Part III, p. 4-27.

XLII) that five parishes appear in both groups, with the highest tenancy as well as the highest per cent of farms mortgaged. A high per cent of farms mortgaged is accompanied by high percentage of tenancy. This relationship is brought out for 1890 and 1925 in the scattergram, Fig. 6. In 1890 there was a slight tendency for parishes with high per cent of farms mortgaged to have a relatively small amount of tenancy but the relationship is not very marked, even though a relatively large per cent of mortgage loans was used to purchase lands.

A brief survey of the farm population of Louisiana will help to explain the mortgage-tenancy situation in the State. In 1925, there were 39,419 white farm owner-operators and 8,494 negro owner-operators. These figures show a change since 1890 with respect to farm owner-operators, when there were 28,749 white owner-operators and 4,973 negro owner-operators. Tenancy has changed more than owner-operator figures within this period. There were 29,648 white tenants and 49,913 negro tenants in 1925 compared with 12,834 white and 27,645 negro tenants in 1890. A comparison is brought out in Table XLIII of the percentage of white and negro farmers for 1890 and 1925.

TABLE XLIII

PERCENTAGE OF FARM TENURE BY COLOR IN LOUISIANA 1890 AND 1925†

	Per Cent Farms Operated by Owners			Per Cent Farms Operated by Tenants		
Year	Whites	Negroes	Others*	Whites	Negroes	Others
1890	36.1	6.2	2.2	16.1	34.7	4.7
1925	27.8	6.4	3.8	22.4	37.7	......‡

It is shown in Table XLIII that negroes are gradually becoming farm owners and the white owner-operators are decreasing relatively. The percentage of both white and negro tenants is increasing. This is not proof that absentee landlordism is gaining to this extent, as most of the tenants have their landlords on the same farm with them. However, the foreclosed farms that have

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†U. S. Census, Farm and Homes, 1890, p. 567. Census of Agriculture, 1925, Part II, p. 982.

*Includes managers, part-owners and men of the red or yellow race.

‡Includes with negroes as colored, a very small number.

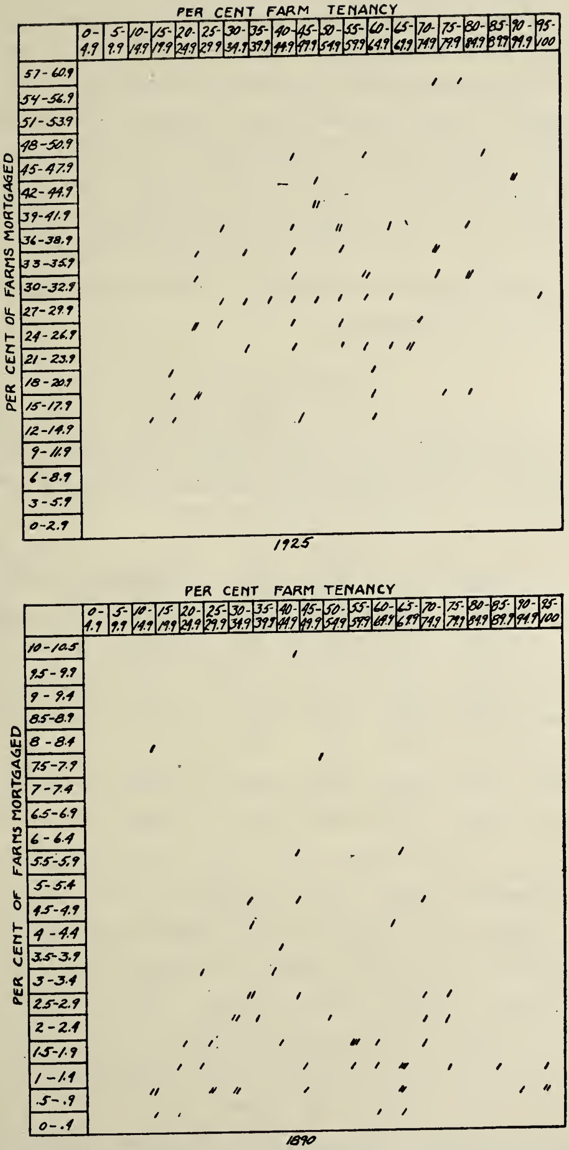

Fig. 6. Relationship Between Percentage of Farm Tenancy and Percentage of Farm Mortgages by Parishes in Louisiana in 1890 and 1925.

been operated by tenants since 1920, in most cases have absentee landlords. There has been a movement on the part of farm owners within the past few years to leave the farm and seek work in other industries. The low returns to agriculture and the attractiveness of high wages in other industries have caused these owners to rent their farms. This has been responsible in part for the relative decrease in owner-operators in the State since the earlier period.

The question of farm mortgages and tenancy has been discussed for the entire State. We will now deal with the problem as it is related to special areas of the State. The Census data is used principally for this discussion.

TABLE XLIV

AMOUNT OF MORTGAGE DEBT PER FARM, PER CENT OF FARMS MORTGAGED, RATIO OF DEBT TO VALUE AND PER CENT OF FARM TENANCY FOR FOUR AREAS OF LOUISIANA, 1920-1925*

	1925 Census				1920 Census			
Area	Average Debt per Farm	Per Cent Mtg.	Ratio Debt to Value	Per Cent Tenancy	Average Debt per Farm	Per Cent Mtg.	Ratio Debt to Value	Per Cent Tenancy
Cotton	$1,858	26.0	39.0	63.3	$1,396	20.1	29.9	60.5
Rice	4,508	16.0	49.5	48.3	3,407	25.3	29.4	38.1
Sugar Cane	3,775	19.7	50.8	43.6	2,713	20.3	30.9	50.5
Fruit and Vegetable	1,119	23.2	38.6	28.4	961	19.6	31.0	29.4
For State	2,336	27.5	42.9	60.1	1,989	20.5	30.0	57.1

The average loan in each of the areas has increased during the period from 1920 to 1925. This increase was 17.4 per cent for the State as a whole. Not only has the average size of the mortgage loan increased but every area shows an increase in the number of farms mortgaged, changing from 20.5 per cent in 1920 to 27.5 in 1925, for the State, as is shown in Table XLIV. Attention is called to the change in the debt-value ratio during this period. The greatest change took place in the sugar cane area, increasing from 30.9 in 1920 to 50.8 in 1925. For the State the change was from 30 per cent in 1920 to 42.9 per cent in 1925. This change was brought about in part by the decrease in land value since 1920. Mortgages that represented only 30 per cent of the farm values in 1920 would represent a much higher proportion of the value in 1925 due to this decrease in farm values, and too, as is indicated in Table XLIV, the size of the mortgage has increased. Along with this increase in the size of the mortgage, number of farms mortgaged, and increase in debt-value ratio, the per cent of tenant farms has been slowly moving upward, changing from 57.1 per cent in 1920 to 60.1 per cent in 1925.

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*U. S. Census, Census of Agriculture, 1925, Part II, p. 598-607. Vol. VI, Part II, p. 598-601, 614-616, 1920.

The survey data for 1928 show that these movements are still in the upward direction, with the exception of farm tenancy. This apparently has remained about constant since 1925. The average loans on farm mortgages have increased considerably. Survey data indicate that the average loan in the cotton area since 1925 is $2,745.00; in the rice area $7,351; in the sugar area $8,323; in the fruit and vegetable area, $746; and for the four areas combined, $6,226.00. The loans indicated here are perhaps a little high as there were a few very large loans included in these data that tend to exaggerate the average size. The average is above that of 1925 when the median is used rather than the arithmetic average. These data support the belief that the size of the mortgage has increased since 1925. Other evidence that supports the data for 1928 is found in the activities of the Federal Land Bank and the First Joint-Stock Land Bank. The loans of these institutions have increased 45.9 per cent since the beginning of 1925. These loans have increased in size sufficiently to cause an increase in the size of the average loan outstanding in 1928.

The fruit and vegetable area has experienced some good years since 1925 and has been able to reduce the mortgage debt. This condition is reflected in the amount of tenancy for the area. When the cropper is excluded, representing 9.4 per cent of the farmers of the area, tenancy is decreasing in the four fruit and vegetable parishes. The greatest gain in tenancy is in the cane area where the size of the average mortgage is increasing fastest.

THE PART CREDIT HAS PLAYED IN FARM OWNERSHIP

Survey data indicate that credit has been an important factor in helping farmers to become owners of the farms they operate.

TABLE XLV

METHODS OF ACQUIRING FARMS BY 535 FARM OWNER-OPERATORS IN LOUISIANA. SURVEY 1928

Methods Used	Per Cent of Total
Cash (100 per cent)	30.0
Credit (100 per cent)	21.4
Part cash, part credit	42.4
Inherited	6.0
Homesteading	.2

Out of a total of 535 farm owner-operators interviewed, 36.2 per cent acquired their farms without the use of credit. Six per cent inherited their farms and 0.2 of one per cent acquired their farms through homesteading. The remaining 63.8 per cent used mortgage credit and of this number, 21.4 per cent used the mortgage to the extent of 100 per cent. The farms that were sold for part cash, and a mortgage accepted for the balance, represented 42.4 per cent of the total. There is no standardized method of paying for farms when they are sold on credit. The down payment ranges from 100 dollars to 50 per cent of the value of the farm. The term of the mortgage varies from person to person. The usual practice is to pay a small cash payment and give a mortgage to cover the balance usually within three to five years, accompanied by notes that are to be paid annually, until the balance is paid.

TENANCY A STEPPING STONE TO FARM OWNERSHIP

Of the 535 farm owners interviewed, 19.4 per cent had been farm tenants at some time prior to becoming farm owners. These men remained tenants on an average of 7.4 years.

TABLE XLVI

DISTRIBUTION OF FARM OWNERS ON THE BASIS OF THE NUMBER OF YEARS THEY SERVED AS TENANT FARMERS PRIOR TO FARM OWNERSHIP. SURVEY 1928

Years	Per Cent of Total
1-3 years	33.7
4-7 years	27.9
8-11 years	22.1
12-15 years	3.8
16-19 years	1.0
20-23 years	8.6
24-27 years	1.0
28-31 years	1.9

Of the present owners who were once farm tenants, 33.7 per cent became owners between 1 and 3 years after becoming a tenant, 27.9 per cent attained the status of farm owner 4 to 7 years after becoming a tenant, and 22.1 per cent worked as tenants from 8 to 11 years before reaching the status of farm owner. There is little probability of a farmer becoming a farm owner after he has farmed as a tenant for eleven years. For those who move from the status of a farm tenant to that of a farmowner, tenancy is a rung in the agricultural ladder, but this number represents only about one-third of the farm owners.

That tenancy is not a rung in the ladder for most Louisiana farmers is evidenced by Table XLVII.

TABLE XLVII

PERCENTAGE DISTRIBUTION OF LOUISIANA'S FARM TENANTS ON THE BASIS OF THE NUMBER OF YEARS A TENANT. SURVEY 1928

Years	Per Cent in Each Class	Number Reporting
1-3	8.4	23
4-7	9.1	25
8-11	9.5	26
12-15	9.1	25
16-19	2.9	8
20-23	4.4	12
24-27	3.3	9
28-31	1.1	3
31 and over	1.1	3
For life	51.1	140

The tenants included in the survey number 274 and 27 per cent of these have been tenants for a period of less than 11 years. The data in the preceding table, Table XLVI, indicated that only 17 per cent of farm owners who were once tenants became owners after 11 years experience as a tenant. This leads to the conclusion that a very small number of tenants in Louisiana at the present time will ever become farm owners, assuming that it will be as difficult to become a farm owner in the future as it has in the past.

Over 50 per cent of the tenants reporting indicated that they had been tenants all their lives. This is a rather indefinite statement but it practically means that these men grew up as sons of tenants, and they have remained tenants. There is a definite tenant class in Louisiana that is propagated by this group and others that report that they have been tenants all their lives. If cropper tenants were included in this phase of this study it would be more evident that there is a permanent tenant class. This class is composed of both whites and negroes. The average number of years the tenant farmer in the cotton area has been a tenant is 11.7, in the rice area it is 12.2 years, in the cane area it is 12.3 years and in the fruit and vegetable area the average number of years tenant farmers have been in this status is 10.6.

These tenants report that 7.7 per cent have at some time in the past owned farms, which were given up for various reasons. The most common reason was that they were closed out because they could not pay their debts. Others reported that sickness caused them to lose the farm and still others indicated that they moved in order to get out of the overflow district. The great majority, however, lost their farms due to inefficiency. Close supervision is necessary for these people if they are to make a living on the farm.

It has been pointed out in the preceding pages that the number of farms, and the number of acres in farms have increased from 1890 to 1920, but decreased from 1920 to 1925. The percentage of mortgaged farms and the percentage of tenancy have increased throughout this period. So far as the relationship between the number of farm mortgages and the percentage of farm tenancy, there apparently is little. In Louisiana, the greater the percentage of farm mortgages the greater the percentage of tenancy. However, the farm mortgage has been an important factor in farm ownership in the State, since more than 60 per cent of the present farm owners indicated that they used the mortgage for all or a part of the purchase price. On the other hand, tenancy has been an insignificant factor towards farm ownership. The State has a permanent class of tenants, and it is believed that improved credit facilities will have little effect on this class.

SECTION VI.

THE LOUISIANA FARMER—A CREDIT RISK

Loans, when repaid must come out of the earnings of some one. The basis for making loans, whether for short or for long periods can be reduced to: first the ability of the borrower to use the loan efficiently; second, the moral character of the individual borrower, and his willingness and habit of meeting obligations promptly. It is essential that the borrower and lender come to a definite agreement and understanding as to the conditions of the loan, how and when it is to be repaid. Only those loans that have a sound purpose should be requested or granted. A large portion of the loans that are made to Louisiana farmers are made on the basis of some kind of collateral but in reality this is a mere form in most instances and the true basis for the loan rests on the moral character of the borrower.

There are two classes of farmers receiving credit from Louisiana lending agencies. The first class consists of those who have some form of property that can be used as security for a loan and the second class, of those who have only their signature to offer. The second class includes a great many of the tenant farmers, and the inefficient farm owners who have gone so deeply in debt that their equity in the farms is practically zero. For the first class of farmers mentioned the risk involved in lending to them is not great for they are in a position to secure the creditor but for the latter class the risk is such that it presents a problem for both lending agencies and society as a whole. For the lending agency, it is a problem of determining how much to advance and at what price, so that the losses can be offset by the unusual gains and at the same time the business in question can be kept in a solvent condition. For society, it is a question of philanthrophy on one hand and the question of sound business practice on the other. To follow sound business practices, would cause many to suffer for lack of capital, which in turn would mean a lowering of standards for individuals of the community, and to practice a form of philanthropy, would likely result in heavier burdens for the group and thereby lowering the productive powers of all.

According to the Agricultural Census of 1925, there were 52,386 farm owner-operators in the State whose total farm holdings were valued at $164,393,120, with a reported farm mortgage indebtedness of $30,270,230. In addition to the farm owners there were 79,561 farm tenants, 34,074 of these were classed as croppers. Therefore, to speak of the Louisiana farmer as a credit risk is a very indefinite concept. However, most credit agencies of the State carry accounts for individuals from each of the groups and this makes it possible for us to deal with credit risk of all farmers using credit rather than with classes of farmers.

FARM INCOMES IN LOUISIANA

The cash receipts from the sale of farm products are used by farmers in the end to pay for goods and services they have received, and to this extent, the amount of cash income is a measure of ability to pay. The cash receipts from the sale of the leading farm products during the year of 1928 are shown in Table XLVIII. As long as these receipts are larger than the cash expenditures that are necessary to bring in this gross income, the farmer is at least able to make payments on his debts.

TABLE XLVIII

ESTIMATES OF FARM VALUES OF VARIOUS CROPS GROWN IN LOUISIANA BASED ON DECEMBER 1 PRICES FOR THE YEARS 1920 TO 1928‡

(In 1,000 dollars)

Year	Cotton (lint)	Sugar Cane	Rice	Strawberries	Vegetables*	Fruits and Nuts
1920	27,524	16,300	27,720	3,846	....	....
1921	20,914	20,936	14,861	4,544	....	....
1922	41,193	28,900	17,782	3,795	....	....
1923	55,734	30,112	17,743	4,664	....	....
1924	55,177	12,756	20,705	4,829	4,115	587
1925	82,397	14,914	21,908	3,412	4,852	713
1926	45,595	6,551	17,096	7,243	9,437	994
1927	52,608	7,523	17,400	3,844	8,923	1,021
1928	61,308	12,509	16,553	7,609	7,565	1,384

The single crop system that is in operation in most sections of Louisiana tends to increase the risk creditors assume for particular years. Very few of the crops that are produced in the State are produced in sufficient quantities to influence the market price for these commodities. A flood may destroy 80 percent of the cotton crop of the State without influencing to any great extent the price that would be received for the remaining 20 percent. Louisiana contributes only three or four percent of the cotton that is produced in the South and in the world market her supply of cotton is almost negligible. Thus the person who depends upon cotton for the sole cash income may experience low prices with low yields or high prices with high yields. In other words, when production in Louisiana is cut down the price does not increase in proportion to offset the loss in yield. The sugar planter experiences the same thing as the cotton farmers with respect to this problem. While Louisiana produces practically all the cane sugar in this country, this production is insignificant compared to the amount of sugar that is imported annually. A disease or some other factor damaging to the cane crop reduces yields and causes much discomfort to the sugar cane grower, and the persons who advanced credit for the production of the crop. The same proposition holds true for the Louisiana rice grower. A low yield does not mean a high price, provided other producing areas do not experience low yields also. A diversification of crops in these different areas would reduce the credit risk to some degree. St. Landry parish is a good example of diversification and apparently the risk of complete crop failure is at a minimum in this parish. The cash receipts and the sources of these are given in Table XLIX for St. Landry for the year of 1928.

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‡Data supplied by the U. S. Department of Agriculture, New Orleans office, 1928 figures subject to revision.

*This item includes both sweet and white potatoes and vegetables grown for commercial purposes.

TABLE XLIX

CROP SALES FOR ST. LANDRY PARISH FOR THE YEAR ENDING DECEMBER 31, 1928*

Commodities	Cash Receipts
39,400 bales of cotton	$3,152,000
100 car loads of sweet potatoes	500,000
90,000 bags of rice	360,000
110,000 heads of poultry	110,000
200,000 gallons of syrup	100,000
300,000 dozens of eggs	90,000
30 car loads of pecans	75,000
40 cars of hogs	66,000
214,000 pounds of cream	85,000
27 cars of livestock	35,000
17 cars of soy bean seed	25,000
150 cars of cabbage	21,000
35 cars of Irish potatoes	21,000

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*Data supplied by the county agricultural agent for St. Landry parish.

St. Landry parish is located in the south central part of Louisiana and is well adapted to a diversified program. Its land area is approximately 616,960 acres and 43 per cent of this acreage is in farms. The agricultural leadership in this parish is first class and farmers are making this area stand out as one of the most attractive and progressive agricultural parishes of the State.

If we compare the above parish with some of the parishes that are not so well adapted to, or have not adopted a diversified program, we will find that the hazards are much greater in the one-crop system. For purposes of comparison, we will take Jefferson Davis parish with 82 per cent of its crop lands in rice, Richland, with 76 per cent of its crop land in cotton, and St. James, with 47 per cent of the farm lands in sugar cane.† The crop failures in these parishes for the same year were as follows: Jefferson Davis, 7.2 per cent; Richland, 10.4 per cent; St. James, 4.9 per cent; and St. Landry, 3.8 per cent.‡ Apparently there is no relationship between the percentage of farms mortgaged and the per cent operated by tenants in the single cropping area and in the diversified areas, since St. Landry has a relatively high per cent of tenancy and mortgages and the other parishes vary above and below St. Landry in this respect.

Merchants and some other lending agencies are more or less responsible for the maintenance of the single crop system. They practically demand that certain crops be planted and this is the cash crop of the area. The tenant that depends upon credit which is secured by a crop lien has no choice as to the crops to be planted. It is a matter of planting the main cash crop of the community or there will be no credit granted. Time is slowly changing this policy, however, and in some parishes of Louisiana agriculture is becoming more diversified. Census data show that there has been a relatively large increase in the number of acres planted to fruits and vegetables, and soy beans in recent years.

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†Louisiana Circular 89, Part I, 1926, pp. 112-123.

‡Census of Agriculture, 1925. "Crop failures are those lands from which there was no crop harvested due to crop failure or destruction from any cause, drought, flood, insects or disease." p. viii.

TABLE L

BANKRUPTCIES AMONG FARMERS AND PER CENT FARM CASES ARE OF ALL BANKRUPTCIES IN LOUISIANA FROM JUNE 30, 1924 TO JUNE 30, 1928‡

Year	Total Cases	Number of Farm Cases	Per Cent Farm Cases are of Total Cases
1921	114	12	10.5
1922	219	32	14.6
1923	423	129	30.5
1924	488	171	35.0
1925	362	77	21.3
1926	473	159	33.6
1927	471	119	25.3
1928	481	93	19.3
Total	3,031	792	26.1

A comparison of bankruptcies of farmers with other bankruptcies is made in Table L. During the eight year period from 1921 to the middle of 1928 there had been 3,031 cases of bankruptcies reported, of this number 792 were farm cases, or 26.1 per cent of the total. Probably there were more failures in farming than are indicated by these figures because so many farm failures or foreclosures are made without legal procedure and this makes it possible for transfers of property to be made without being listed as foreclosures. The above data serve as a basis for comparing farmers with all other business men with respect to credit risk but do not help to compare farmers with any other particular group of business men.

The amount of losses that credit agencies experience by advancing farm credits is a possible way of checking on the risk involved. Reports from thirty-eight merchants indicated that 72.3 per cent of their total sales were to farmers and that 91.3 per cent of the credit extended was to farm customers. These merchants have been in the same business for an average of 13.43 years and this indicates that merchants who are conservative and conduct their business on a strictly business basis, have little fear of failure due to farm credits. These merchants have been in business from four to forty-four years and have been financing farmers for this period.

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‡Year Book of the U. S. D. A., 1924, p. 1130 and 1928, p. 1065.

Most of them report that their business is about the same as it has been over a long period. It was suggested in a preceding section that merchants assume risks that other credit granting institutions would not, by extending credit to persons who do not show much promise of paying the debt in the future. This practice increases the risk of farm credit to that extent. The amount of bad debts for merchants reporting was $109,551 in 1928 which represented 7.2 per cent of their total sales for the year. Some of this loss was due to sales made several years back and does not represent one year's business losses. A study made by Mr. Morehead in 1926 of 89 merchants granting credit to farmers indicated that losses from uncollectable accounts amounted to 3.5 per cent of total accounts for hardware stores and 7 per cent for rice warehouses, the average for general merchandise, grocery and feed, and hardware and implement stores being 4.8 per cent of the accounts.*

Other costs of doing a credit business with farmers as indicated by the survey of 1928, amounted to 2.7 per cent of the total sales to farmers. This item when combined with bad debts represents 9.9 per cent of the business done with farmers and must be regained in some way. It is usually compensated by higher prices for the services and this results in the expensive merchant credit that has prevailed in the State.

The losses experienced by commercial banks are very slight according to reports made by the bankers. In the first place they eliminate the greater risks by refusing to grant credit, and those farmers who do not have a high credit rating must put up collateral to cover any loan that is obtained. The Intermediate Credit Bank advanced approximately 21 millions of dollars to farmers through their agents from 1924 to the end of 1928 and the losses that were experienced by this institution have been less than one per cent. (.0099)

Long-term credit has been granted to Louisiana farmers by banks with relatively little loss. The banks cooperating in this study reported that their losses during 1928 due to bad loans to farmers were practically nil. Eleven foreclosures were reported which involved 1.2 per cent of the total farm mortgage loans outstanding, but these foreclosures were handled without a loss to the bank. A number of banks reported that they have never foreclosed on a farm mortgage.

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*Morehead, S. D., Merchant Credit to Farmers in Louisiana, p. 41.

The Federal Land Bank and the First Joint-Stock Land Bank have made a number of foreclosures on Louisiana farm mortgages within the past few years, but this is mainly due to the legal requirements forcing amortization collections when the farmer is not in a position to raise the money with which to pay. According to the report of the Federal Farm Loan Board, the Bank of the fifth district which comprises Mississippi, Alabama, and Louisiana, instituted 6,951 foreclosures from date of organization to December 31, 1928. Of this number, 5,518 were dismissed, 49 were pending, 249 ended by purchases of land by third parties, and 1,135 farms were acquired outright. The total gains in connection with lands disposed of were $105,117 and the total losses were $6,405. The First Joint-Stock Land Bank reported no foreclosures for 1928, but the delinquent amortization installments on December 31, 1928 amounted to $6,956. The most of this was delinquent for 30 days.

The losses experienced by insurance companies on farm loans in Louisiana were less than $2,500 during 1928 according to the report of those cooperating in this study. Only six foreclosures were instituted and this involved a very small per cent of the total farm loans in the State. The losses amounted to .02 of one per cent of the farm loans they held in Louisiana.

The attitude of farmers toward credit institutions that serve them is a factor in their willingness to pay their debts. The question, "Do you believe that the credit facilities are adequate to meet the needs of Louisiana farmers?" was asked each farmer who contributed this information. Seventy per cent of the owner-operators and 76.8 per cent of the tenants answered the question in the affirmative. The criticism from most of these was that credit was too easy for most farmers and as a result, both farmer and creditor suffered. Those who felt that credit facilities were not adequate, were usually men who were unable to secure credit due to their past records. As long as credit can be obtained from the agency that is preferred, the farmer apparently is contented. The preference of Louisiana farmers for the different sources of credit is given in Table LI.

TABLE LI

PERCENTAGE DISTRIBUTION OF FARMERS IN LOUISIANA ON THE BASIS OF PREFERENCE FOR CREDIT AGENCIES. SURVEY 1928

Credit Agency	Per Cent Owner-Operators	Per Cent Tenant-Operators
Banks	53.8	28.9
Merchants	15.7	23.2
Individuals	4.5	4.9
Credit Corporation	19.1	6.7
Landlord	....	26.6
Other Sources	2.2	....
No Preference	4.7	9.7
Total	535	274

In the above table it is shown that farmers have their preference for the different agencies and they use those which they prefer in most cases. A few farmers indicated that they were not able to use bank credit but preferred it to the expensive merchant credit which they could get. The dependence of the tenant farmer upon the landlord is indicated in the above table. Twenty-six per cent preferred the landlord to any other source. This is perhaps the best source for them since the landlord more than any one else can determine how much credit can be effectively used by the tenant.

In order to find out what merchants and bankers thought about farmers as credit customers, they, too, were asked to answer specific questions. In answer to the question, "Are farmers as good a credit risk as other customers?" 76.3 per cent of the merchants answered yes, 16 per cent answered no, and the remainder would not express themselves. Those who answered in the negative indicated they thought that the farmers were as good moral risk but due to the farm hazards they were not in a position to pay their bills as promptly as the person on a salary or with a steady income. All bankers indicated that they sought the farmer's business and that their loans were just as secure with the farmers as with others, however, bankers as a rule are more conservative than merchants in making loans.

While there is no definite measure that can be applied to determine the risk involved in extending credit to farmers, with the exception of a small group of insolvent farmers, as was mentioned on page 85 the risk is not sufficient to discourage credit agencies from seeking the farmers business.

SECTION VII.

SUMMARY AND CONCLUSIONS

Louisiana farmers need and are using the three types of credit, short-term, intermediate and long-term credits. Short term credit is needed in harvesting and marketing crops, and for other purposes. Intermediate credit is needed to finance the operating expenditures which necessarily must be made during the early production period of the crop season and to take care of the expenses of making improvements, as well as to assist in meeting expenses that are involved in livestock farming. Long term credit finds an important place in assisting farmers in becoming farm owners, in helping them to maintain the status of farm ownership by converting short-term loans into the long-term loan that can be repaid by the amortization plan from the proceeds of the farm, and to make permanent improvements on the farm that result in more efficient farm operations.

These various types of loans have been supplied by different agencies, some overlapping of services of such agencies. Primarily, the short-term loans have been supplied by local banks, merchants, landlords or individuals and farm associations. The middle-term loans have been made by the same agencies, and also, since 1924, by the Federal Intermediate Credit Bank of New Orleans. Long-term loans have been supplied, mainly by the Federal Land Bank, the First Joint-Stock Land Bank of New Orleans, life insurance companies and commercial banks.

It has been seen in the analysis presented, that the amounts of personal and collateral loans used by Louisiana farmers vary for different types of farming. This class of loans was most important in the sugar cane section where the average amount per farm for farmers using credit was $6,288 for owner-operators and $831 for tenants, as compared with $614 for farm owner-operators, and $313 for tenants in the cotton area. Retail merchants, local banks and farm associations are the most important agencies supplying this class of credit, and all of these have an important place in the credit systems in different areas of the State. These institutions in providing credit, are rendering valuable services to agriculture but at the same time there are certain weaknesses that must not be overlooked.

There were 231 commercial banks operating in the State at the beginning of 1928, with resources of over 526 millions of dollars. Generally speaking, these institutions are managed in an efficient manner, and are of great assistance to farmers, not only by supplying credit, but also by influencing some of the farmers' business practices. In some cases bankers supervise certain farm activities of borrowers. Farmers will find it helpful to avail themselves of such aid. However, there should be close cooperation between bankers, farmers and farm demonstrators from the Agricultural Extension Division in order that such program of activity may fit the needs of the situation. With the scientific information furnished by the extension worker, the experiences of the successful banker and with the brains and brawn of the farmer, the farm operations can be put on a more efficient basis.

Apparently banks have been conservative in their lending policies and few losses have occurred, even though a large percentage of the farmers reported that they obtained loans that were without specific security. If the practice of advancing loans on single name paper were restricted, the risk would be less and there would be less necessity for banks collecting interest in advance, and requiring bank balances to be maintained when farmers need the entire loan to pay operating expenses on the farm. Both of the above practices result in higher costs to the farmer and the latter encourages a larger loan than is actually necessary for the person who borrows under such circumstances. While interest rates of ten and twelve per cent are lower than those charged by merchants in most instances, it seems that an interest rate which exceeds the legal rate of eight per cent is likely to place a hardship on farmers because many farmers are unable to make such returns on their investment. The more conservative farmer will not borrow money if he sees that the interest rate is so high that there is no chance of profits for him. Thus the high rates tend to discourage some loans that could be used to an advantage on the farm. As a result, both farmers and bankers operate on smaller volumes of business.

The survey data indicate that banks in all sections of the State have adjusted the period of short-term loans to meet the time requirements of agriculture for such loans.

Much discussion is to be found on the evils of merchant credit in the South. While there is no real evidence in support of the merchant credit system as it now operates, it seems that it will continue to have an important place until farmers change their methods and practices to the extent that specialized credit institutions can afford to assume the risks that are now borne by merchants.

There is much room for improvement in the system as it now operates. In the first place, merchants would find it advantageous to limit their accounts to good risks. Every account that is opened should be secured in such a way that losses through failure to collect accounts are reduced to the smallest amount possible. This practice would permit the services of merchants to be rendered for a price more nearly comparable to that charged by other agencies.

Merchant credit in Louisiana is becoming less important. Many merchants, who a few years ago were in the farm credit business, are now operating on a strictly cash basis. They have found that losses due to uncollected accounts were sufficiently large practically to balance the gains that accrued from the credit business. The fact that a number of the old line supply merchants have changed their policies, has caused an apparent increase in merchant credit throughout the State when a study is made of merchants who still extend credit to farmers. Survey data made it appear that merchant credit was on the increase in the State because only those merchants who were doing a credit business made reports. The belief that merchant credit is really becoming less important is supported also by the conclusions drawn by Professor Morehead from his study of merchant credit to farmers in Louisiana.*

The work of agricultural credit corporations, and farm associations in some sections is making it possible for merchants to discontinue the extension of credit to farmers. These institutions supply the farmers with cash, making it possible for them to pay the merchant for farm supplies at the time they are purchased. This arrangement improves conditions for all parties concerned, and further developments in this direction would be of advantage.

Merchants are not functioning primarily as credit agents, their business is to buy and sell commodities. They cannot compete on equal terms with specialized credit agencies, consequently, merchant credit is the most expensive type used by farmers.†

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*Morehead, S. D., Merchant Credit to Farmers in Louisiana. 1929, p. 76.
†See Table XXX, page 63.

Those farmers who are able to obtain loans at relatively low rates of interest from banks or other institutions will find it to their advantage to use this credit and pay cash at the store. The merchants in most cases will welcome any system that will help farmers to get on a cash basis at the store.

Farm associations in the fruit and vegetable area are performing a service that means much to the poorer class of farmers of the area. Without these agencies, many farmers would necessarily go without credit aid throughout the year. Charges made by these associations for credit are relatively low where the loan is used for nine or ten months. The greatest complaint on the part of farmers was that a three months loan cost as much as the loans that ran for the year.

A bad practice exists among the managers of some of these associations in granting loans on the basis of what the competing association proposes to do for farmers, rather than on the basis of the farmers' ability to use the loan profitably. This type of competition between association managers at times causes too large loans to be made and results in wasteful practices on the part of the less prudent farmers.

To be of the greatest benefit to farmers, these associations must serve them according to their needs, and these should be based on sound business principles. The practice of charging farmers interest on funds from September to the date of harvest when these funds are used only three and four months works a hardship on the farmers and can be remedied by the association managers by providing for this cash at the time farmers need it rather than securing sufficient funds at the beginning of the season to meet the needs throughout the year. This would necessitate monthly borrowings by the associations but at the same time it would make it easy and without loss to charge the farmer for his credit on the basis of the time the loan runs. Should the farmer demand the right to draw on the association at will, the above suggestions would not apply.

The long-term credit problem is well taken care of by the Federal Land Bank, and other agencies operating in the State. The interest charge as well as the term of loan is satisfactory to those who are using this type of credit. These institutions are serving primarily farmers who own farm lands. They have not helped very many tenant farmers to become farm owners. In most cases loans from these agencies do not exceed forty or forty-five per cent of the value of the property that is accepted as security. If a person wishes to become a farm owner, he must have at least fifty per cent of the value of the farm or be able to find someone who will accept a second mortgage, and few lending agencies will advance as much on a second mortgage as was extended on a first mortgage. This condition makes it very difficult for men of ability but who have only a small amount of capital to become farm owners.

There seems to be a place for a specialized institution to handle second mortgages on farms for worthy persons who desire to buy farms. With a conservative policy of appraisals, a system might be established whereby bonds issued on second mortgages could be marketed to finance this activity. Interest rates necessarily would be higher than rates on first mortgages due to the greater risks, and the administration of such a system would need to be of the most conservative nature. Possibly such a system could be established by legislation as an institution subsidiary to the Federal Land Bank.

The functioning of the Federal Farm Loan System through national farm loan associations is apparently efficient. However, in Louisiana there are too many associations. A consolidation of the smaller units wherever it is possible is desirable. The volume of business that is done by many of the national farm loan associations is too small to justify the employment of a secretary who is capable of managing the affairs of the association to the best interest of the system and the community. Either consolidation should take place or a further educational campaign should be made to teach farmers who are now carrying the mortgages that have a high interest rate, the advantages of converting these loans to long-term loans with the Federal Land Bank.

There is also room for improvement in the work of obtaining abstracts to land titles. The variation in costs from community to community is too great, and measures should be adopted by the national farm loan associations to standardize these costs as nearly as conditions will permit.

Farmers who require large loans find them available at the First Joint-Stock Land Bank. The average loans for this institution at the close of 1928 amounted to $19,320 as compared with the average loan of $2,482 from the Federal Land Bank. The cost of securing loans from the Joint-Stock Land Bank is approximately the same as that for the Federal Land Bank loans and the conditions under which loans are secured involve even less preliminary action on the part of the borrower. However, this institution is serving a relatively small number of farmers in Louisiana.

Insurance companies have sought the larger loans, and have rendered an important service in financing agriculture. Their loans are made for convenient terms, and at a low rate of interest. The tendency at present appears to be for insurance companies to withdraw from the field of farm mortgage investments, as their loans are actually decreasing throughout the country and in Louisiana.*

The amount of farm mortgage paper held by commercial banks in Louisiana is declining. It was estimated as already indicated that these loans amounted to 26.7 millions of dollars in 1920. The estimate for 1928, based on survey data, was approximately eleven millions of dollars. This difference is accounted for by the fact that many of the loans that were outstanding in 1920 have been paid, and of those that have not been paid, a large amount has been converted to the long-term mortgage loan with the Federal Land Banks. Most of the loans that have been made by the Federal Land Bank and the Joint-Stock Land Bank have been used to pay off mortgages and other debts.†

Commercial banks fill an important place in the mortgage credit system of Louisiana. Farmers who desire mortgage loans for periods of less than five years will find it to their advantage to secure these loans from the local bank. Interest rates are higher, ranging from eight to ten per cent as compared with five or six per cent with the other agencies mentioned above, but the difference in rates is offset by the difference in time the loans run, unless farmers borrow with the intention of paying the loan within a short term. This is contrary to the spirit of the ruling which permits loans to be paid early with a penalty attached.

While there are certain defects in the credit system for which the institutions are more or less responsible, at the same time farmers also are responsible for these defects. Farmers, for the most

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*See Table VI, p. 21.
†See Tables XXV and XXVI, pp. 55-57.

part, have not employed proper business methods and practices on the farm. Many lack a good knowledge of their own business as is evidenced by their failure to keep simple records which would be of great assistance in planning the farm enterprises. Again, there is a tendency for farmers to seek loans when there are no provisions made to repay the loans. As a result, debts are not paid promptly, and in some cases not at all. Any group of people who wish to maintain a high credit rating must meet debts promptly when due. Farmers could easily make their credit obligations such that there will be some salable products from the farm at the time an interest payment or the principal is due. This would mean greater diversification on most farms, and the practice of thrift by farmers who use credit.

Tenant farmers in particular need to improve their credit standing. It has been pointed out already that the amount of credit per tenant farmer is relatively small, but this small amount of credit costs them a great deal, because only the higher priced credit is available for them. During good years, tenant farmers usually have the opportunity of accumulating some cash that could be used during poor years. If this is properly handled, it is possible for them to get on a cash basis, and in this way establish a higher credit rating to help them when credit is really needed.

There are communities in Louisiana that need the services of additional institutions or better service from existing institutions. These communities are composed of small land owners and tenants. In these communities it is important that thrift be encouraged but existing agencies have done very little to encourage saving. In some cases their influence has been in the opposite direction.

The "credit union" provided for by the State Legislature in 1924 is recommended for these communities, not for the sake of additional lending power, but for the influence these institutions would have on the members in encouraging thrift. Thrift plus sound business methods on the farm cannot be over emphasized, if Louisiana's tenant farmers and small land owners are to place themselves on the same footing as other farmers.

SUMMARY OF SUGGESTED IMPROVEMENTS

1. Economic conditions in Louisiana farm communities would be improved if all credit institutions were to abolish the practice of granting credit without security.

2. While the existing institutions are supplying ample credit to farmers who are in a position to obtain credit, there are many farmers who are unable to negotiate loans, and this condition, in cases, is brought about by circumstances over which the farmer has no control. Therefore, in small communities where the farmers are predominantly tenants and small owner-operators, credit unions, organized under the act of 1924, may be advantageous.

3. Small, inefficient national farm loan associations can be consolidated, to an advantage, where it is possible, and competent secretary-treasurers employed.

4. Merchant credit as supplied at present, is too expensive and, wherever conditions are suitable, farmers will find it advantageous to borrow cash from the bank or other institutions at the prevailing rate of interest and eliminate store credit.

5. Merchants can encourage cash business by making a difference between cash and credit prices and advertising to the farm group that this difference exists.

6. Apparently there is a distinct place for more agricultural credit corporations in the State and farmers can take advantage of this source of intermediate credit at reasonable rates by establishing a closer cooperation among themselves and between the farmers and the financial agencies.

7. Farmers will find it advantageous to insist upon a closer cooperation between bankers, extension workers and farmers, so that information and advice received from these agencies may be the best available, and may find more general application in our farm practice.

8. It would be highly desirable if the State Banking Department would segregate bank loans according to purpose and make this a part of the biennial report. This would assist much in analyzing the credit problems of the State.

The principal objects of this study have been to analyze the agricultural credit situation in Louisiana and to lay the ground work for further research studies which can take up specific problems in greater detail. Among the problems to which attention should be given in such studies are the following:

1. A detailed study of agricultural credit corporations in the State with the view of discovering their place in the credit system in different farming areas of Louisiana.

2. The causes underlying farm loan foreclosures in Louisiana.

3. Credit as a factor influencing land utilization in the cut-over pine lands of Louisiana.

4. A detailed study of how credit can change the tide of tenancy in the State and help the landless farmers to become owners of the land they cultivate.

5. Factors affecting the efficiency of the different credit institutions and their effect on Louisiana's agriculture.

As a concluding statement it is desired to emphasize that there is no intention to urge the granting of credit to all farmers in Louisiana. There are some farmers who are not capable of using credit to their own advantage or that of the community. However, those farmers who are capable and need credit with which to operate the farming business more efficiently should be able to secure this credit in proper amounts, and under suitable conditions as to term, security, and interest rates.

APRIL, 1930. LOUISIANA BULLETIN No. 209.

MANAGEMENT OF FARM WOODLANDS IN LOUISIANA

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In the preparation of this bulletin we wish to acknowledge the help given by former State Forester W. R. Hine and the field force of the Louisiana Division of Forestry, the County Agents of the Agricultural Extension Service of Louisiana State University, officials of various lumber companies, and the many farmers who cooperated in giving information on local conditions.

We also wish to acknowledge our sincere appreciation of the assistance given by the Yale Forest School in furnishing complete field notes on over 150 sample plots of typical loblolly and shortleaf pine stands in central and northern Louisiana. A large number of these plot records, together with those collected by the authors in various parts of the state, were used in the preparation of the yield tables.

FOREWORD

The need for timber on the farm is self evident. In every farm operation timber is used in some form. All farm buildings from the farm home to the chicken house are most economically and quickly constructed with lumber and timber. The best and most economical fence is one built with wooden posts. If these posts are creosoted, the fence is built of the most durable of all the available fencing materials.

Louisiana contains large areas of land which are not adapted to farming. It is land that is at present too poor to repay the costs of cultivation. The Business Men's Commission on Agriculture in 1927 stated: "Men have been induced to settle upon land which, under existing conditions, offers no reasonable prospect of a decent living. Such crops as they raise are a constant drag on an inelastic market." Forestry offers a profitable use for such lands.

We can grow timber faster than most states and as fast as any. It is one of the few crops that is not being overplanted. In fact, the United States is cutting its timber four times as fast as it grows. We can hardly find a better assurance of a stable market than this wide spread between consumption and production. Our farmers are hardly in position to refuse the opportunity that forestry offers to add to their cash income.

It is to assist farmers in their forestry practices that this bulletin is presented. It contains no theories, but practical suggestions that are the result of experience and study. Its suggestions have been put in practice on large areas of timber land with profit to the owners and the material contained here is the result of a study of these areas.

MANAGEMENT OF FARM WOODLANDS IN LOUISIANA

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INTRODUCTION

Since the time of the first settlers, Louisiana has been blessed with an abundance of timber. For years we have been cutting without thought for the future. Today we are faced with the probability of securing our timber from the Pacific Coast with high freight rates, *unless* we take steps to conserve and develop our forests. Many progressive lumber men of the state are caring for their timberlands and looking toward the future.

But what of the farmer? So far he has given little thought or care to his forest lands and yet he owns 15% of the timberland of the state, totaling nearly two and a half million acres. In addition, over half a million acres of farm land are lying idle that could well be reforested, making a total of three million acres of potential timberland. This area is equal to the combined acreage of Caddo, Bienville, Bossier, Claiborne, Webster, and Union Parishes. Such a large area certainly should be given careful and thoughtful consideration.

This bulletin concerns itself particularly with farm woodlands in the shaded areas shown on the accompanying map. The general conclusions and recommendations may also be applied to the longleaf and slash pine areas. The hardwood areas will also profit by the observation of care in handling along the general principles laid down in this bulletin.

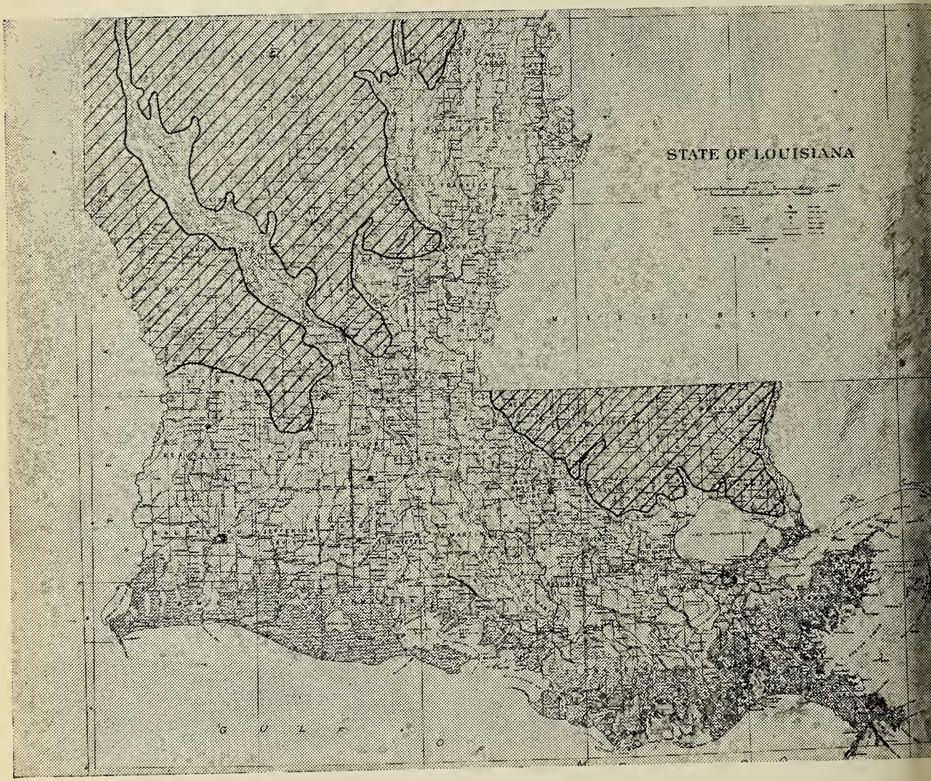

FIGURE I.—Shaded Portion Shows Area Considered In The Bulletin.

The region is one in which natural reforestation is obtained with least trouble. It presents the least difficulty in respect to fire prevention as it is an area that is well cut up by roads and small farms. Labor conditions are also good, and farmers can use their farm labor during periods when the demands of the farm are lightest.

SPECIES

The Loblolly Pine (*Pinus taeda* L.) and the Shortleaf Pine (*Pinus echinata* Mill.) are the species best adapted to the farm woodland. The former is particularly well suited by reason of its rapid growth, as it grows faster than any of the southern pines. These pines are also desirable because of their adaptability to a variety of sites, the wide range of uses to which their wood can be put and the certainty of demands constantly increasing in variety. This insures competitive markets which tend to raise the level of prices offered for the products of the farm woodland.

YIELDS

The yields to be expected from typical farm woodlands vary within wide limits depending on the fertility of the soil, available moisture, temperature, and other factors of site. In this bulletin three site classes are recognized: good, medium, and poor. While these site classes are difficult to determine accurately by casual observation, the owner can determine them on the basis of soil fertility and the thriftiness of the trees. As given in the tables, good sites are those where rapid height growth and thrifty trees are found and where the soil is of good quality. Poor sites are those where growth is slow and trees do not look thrifty, and where the soil is poor. Medium sites are average sites lying between these two extremes. The yield for each site class in boardfeet and cords is shown below. For example a thirty year old stand will contain 21,000 boardfeet on a good site, 15,300 on a medium site, and 10,400 boardfeet on a poor site (Table I) or 46, 37, and 36 cords on good, medium, and poor sites, respectively (Table III). Table I gives the yields in boardfeet measured by the International Rule and Table II gives the yields in boardfeet measured by the Doyle Rule. The Doyle Rule is commonly used in Louisiana but does not give the true volume of logs, especially with small logs where the values are much too low. The International Rule gives very nearly the actual amount which will be sawed out. Table III gives yields measured in cords.

TABLE I

YIELD IN BOARDFEET PER ACRE

Loblolly and Shortleaf Pines — International ¼ Inch Rule

Age In Years	Average Yields in Boardfeet Per Acre		
	Good Site	Medium Site	Poor Site
20	8,600	3,800	....
25	16,000	10,200	5,600
30	21,000	15,300	10,400
35	24,200	19,100	14,300
40	26,800	22,100	17,600
45	29,000	24,700	20,200
50	31,000	26,800	22,400
55	33,000	28,700	24,300
60	34,800	30,300	25,800
65	36,500	31,700	27,000
70	38,100	33,000	28,100

Note:—Yields are based on average conditions as found on 100 sample plots scattered over the State.

Volumes include all trees 7 inches and over measured at 4½ feet above ground.

TABLE II

YIELD IN BOARDFEET PER ACRE

Loblolly and Shortleaf Pines

Doyle Rule

Age In Years	Average Yields in Boardfeet Per Acre		
	Good Site	Medium Site	Poor Site
20	200	....	....
25	4,700	2,300	300
30	8,500	5,500	3,100
35	11,900	8,400	5,700
40	14,900	11,100	8,100
45	17,200	13,600	10,400
50	18,900	15,700	12,600
55	20,400	17,400	14,500
60	21,600	18,800	16,000
65	22,800	20,100	17,300
70	23,100	21,300	18,600

Note:—Yields are based on average conditions as found on 99 sample plots scattered over the State.

Volumes include all trees 9 inches and over measured at 4½ feet above ground.

TABLE III

YIELD IN CORDS PER ACRE

Loblolly and Shortleaf Pines

Cords

Age In Years	Average Yields in Cords Per Acre		
	Good Site	Medium Site	Poor Site
15	30	22	16
20	36	28	21
25	42	33	26
30	46	37	31
35	49	41	34
40	52	44	37
45	54	46	39
50	55	48	41
55	56	49	42
60	57	50	43
65	58	51	44
70	59	52	45

Note:—Yields are based on average conditions as found on 100 sample plots scattered over the State.

Volumes include all trees 4 inches and over measured at 4½ feet above ground.

These yields are the results of the measurement and computation of the volumes of the trees on more than 100 plots* of typical loblolly and shortleaf pine land throughout Louisiana. As they are typical stands they have been burned at frequent intervals throughout their lives, and such burning has reduced the yield. Better yields will result when the land is given complete protection from fire.

PROFITABLE PRACTICES

To secure the greatest possible return from the farm woodland certain practices are necessary.

Fire prevention is the first requirement in the successful management of farm woodlands. Fire has long been the greatest enemy of the forest and of forest growth. No manufacturer could conduct a successful business if he allowed his factory to burn every year. That is what a woods owner does when he allows fire to go through his woodland every year. His growing trees are a factory producing wood. It is not profitable to burn the factory and thus reduce the output.

To prevent fires entering the woods the owner should plow a fire line around his land. This line should be ten feet wide and should also be plowed along the roads, about 25 feet from them. Where natural fire breaks, such as running streams, exist they can be used in place of the plowed fire line.

The law protects and assists an owner in his effort to keep fires from burning his woods. If any person sets fire to the woods of another, or allows a fire he started to enter the land of another and damage it he is subject to fine or imprisonment or both. He is also liable for the damages resulting from the fire and can be sued to obtain them. The State Division of Forestry has established forest protection units in different parts of the state in which the state and federal government cooperate with the land owners in forest protection. The farmer should take advantage of this additional help wherever possible.†

Fire prevention is not the whole of forestry, but it is by all means a primary consideration. Without fire prevention no young loblolly or shortleaf pine can grow to replace those big enough to cut. Fire makes openings in the bark through which insects and disease enter the tree causing it to become weakened and a victim of the first severe wind storm.

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* These plots contain varying proportions of Loblolly and Shortleaf Pines. On most of them Loblolly predominated, forming 80% or more of the stand.

† Information relative to this cooperation may be secured from the State Forester, Department of Conservation, New Orleans, La.

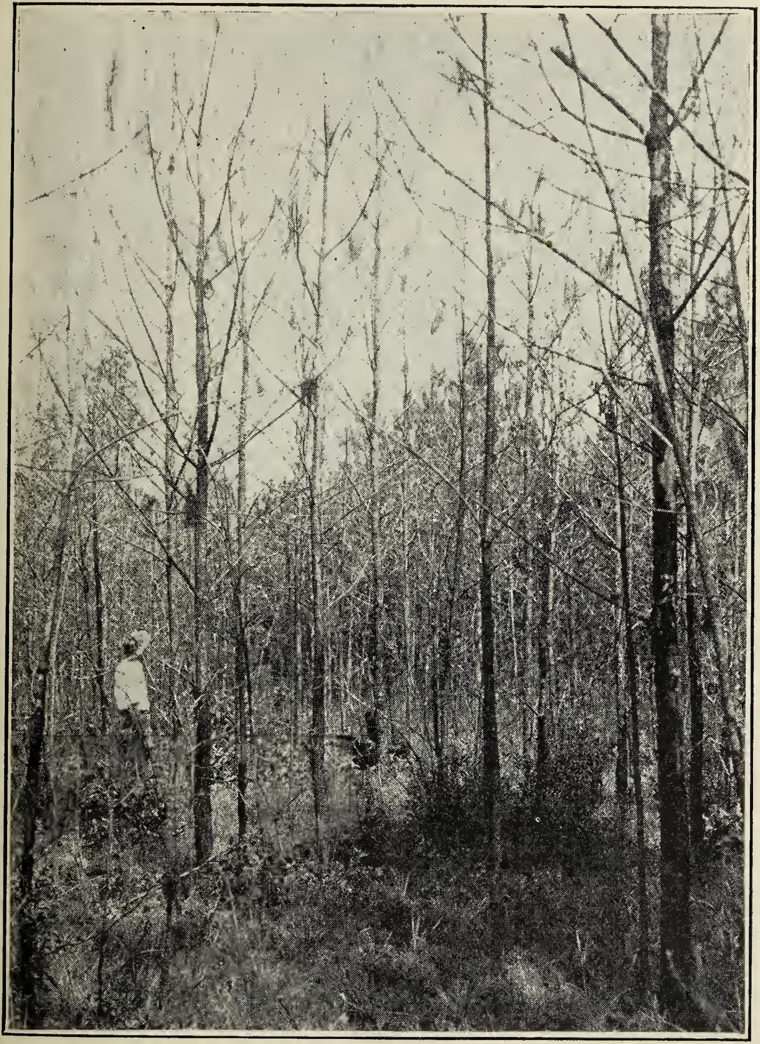

Plate I—*Eleven Year Old Stand of Loblolly Pine in La Salle Parish Entirely Killed by Fire in August.* (Photo by U. S. Forest Service)

OBTAINING THE STAND

A good stand may be obtained either by planting the land with seedlings of the desired species, or by the natural seeding of the site from trees now on the land or adjacent to it.

Establishing a stand by planting with seedlings is seldom necessary on farm woodlands and, therefore, is not discussed in this bulletin. Where planting is required, one year old nursery grown seedlings should be used.‡ These can be secured at cost from the State Division of Forestry through the Extension Forester or direct from the Division of Forestry, New Orleans.

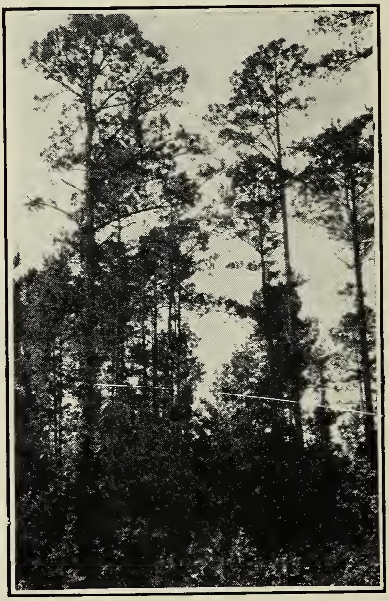

Plate II—*Good Reproduction Three Years After Cutting as a Result of Careful Marking and Logging. De Soto Parish.*

Natural reforestation is entirely satisfactory in Louisiana and is usually recommended. The law requires that two good seed trees per acre be left on all forest land either being cut, or bled for turpentine. A seed tree is defined as "a healthy tree not less than ten (10) inches in diameter four and a half (4½) feet from the ground". It should also be a tree with a large crown and tall enough to scatter the seed well over the area. If this law has been observed, adequate stocking of small seedlings should result within a year or two.

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‡ "Forest Planting in Louisiana" by N. D. Canterbury, Louisiana Division of Forestry, New Orleans, La. "Planting Southern Pines" by P. C. Wakeley, Leaflet No. 32, U. S. Department of Agriculture, Washington, D. C.

To be adequately stocked the land should have at least 1000 to 1500 (preferably more) seedlings per acre. Most of the land will have more seedlings than this. The young trees will compete with each other for room to grow, and the faster growing ones will win. The others will die and decay thus adding fertilizer to the soil and aiding the growth of the remaining trees.

Grow some sawlogs. Every farmer needs some lumber to repair his buildings and to construct new ones. He should grow the timber himself and have it cut at a local mill. The mill owner will be glad to saw the logs at a fair price per thousand, cutting the sizes wanted. Help to make every farm more nearly self supporting by producing lumber for home use.

When the stand is from three to six inches in diameter, cut out the dead trees, the dying trees, and some of those that seem to be falling behind. Cut also the hardwoods and those pines that are crooked and diseased. In that way the growth of the stand is speeded up, and the farmer reaps an immediate return from the sale of the material he cuts. This will be almost entirely of pulpwood size with some posts and fuelwood.

TREES TO CUT FOR FIREWOOD

Crooked Trees
Forked Trees
Diseased Trees
Bushy-Topped Trees
Slow Growing Trees

Continue the thinnings as often as the stand becomes crowded. Under favorable conditions they can be repeated every five to ten years. When the trees reach a diameter of 14 inches and over, they are of sufficient size to be profitably cut and sold for saw logs. By that time the stand will contain from 150 to 200 trees per acre. Then cut your timber, obtaining the best price possible, and leave seed trees for the next crop.

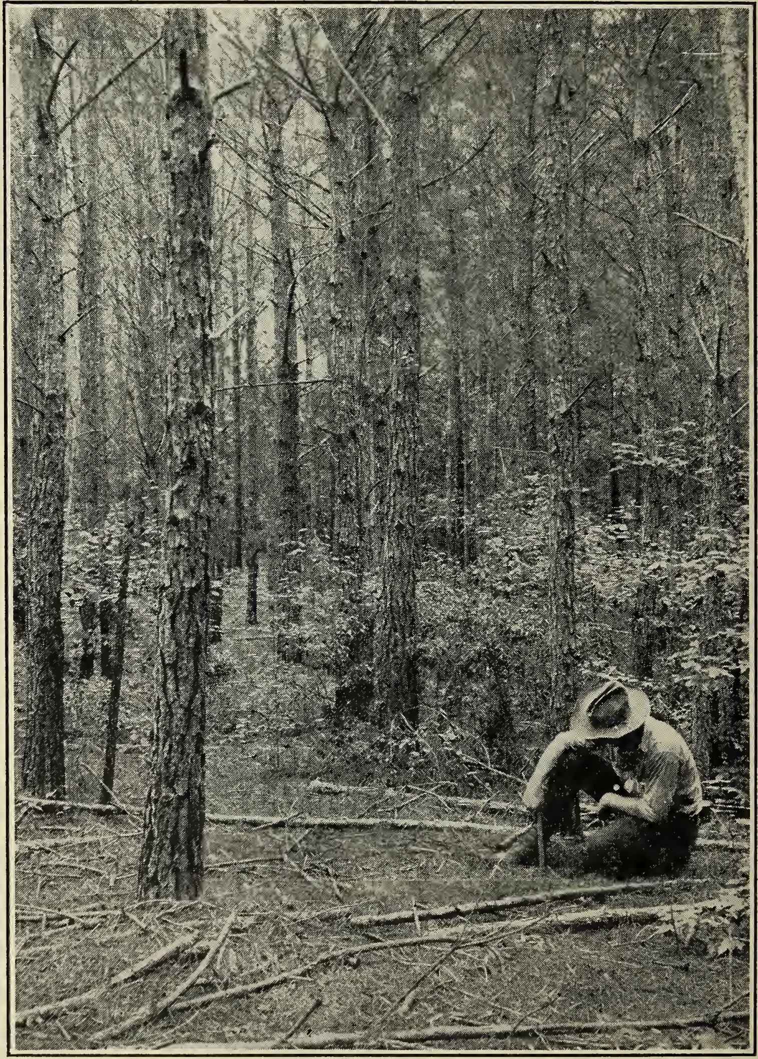

PLATE III—*Twenty-one Year Old Stand of Loblolly Pine in Need of Thinning. Caldwell Parish.* (Photo by U. S. Forest Service).

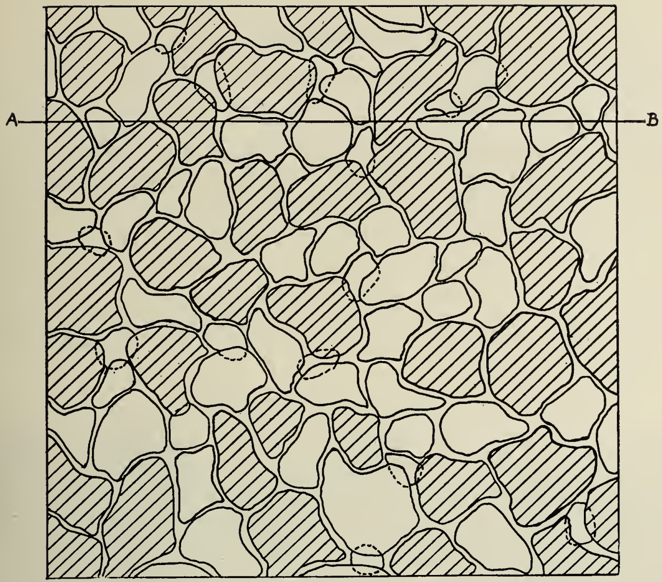

FIGURE II—*Thirty-five Year Old Loblolly Pine Stand in Need of Thinning. Shaded Trees to be Removed in the Thinning.*

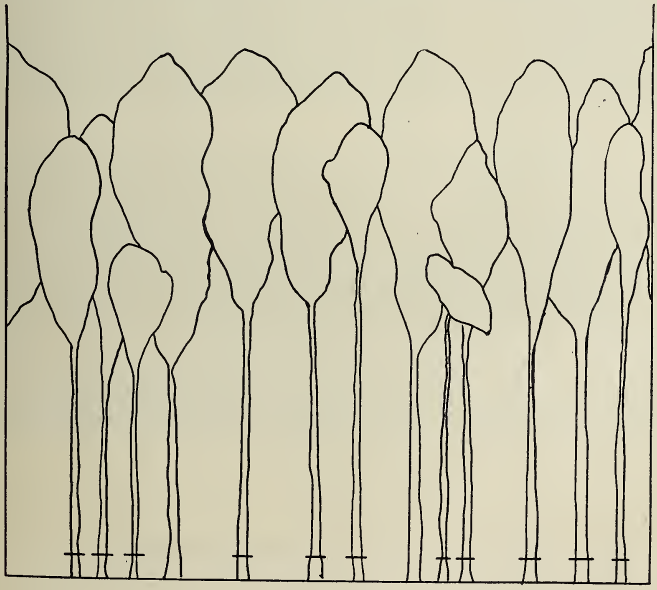

FIGURE III—*Same Stand as in Figure II Showing Cross Section at Line AB. Trees to be Removed are Marked.*

MARKETING

Marketing is very largely a matter of obtaining the best possible price for saleable material. Local prices are governed entirely by economic conditions such as the supply of timber available and the distance from the market. Some concerns are at present buying the farmer's timber at their plants for less than they can cut and deliver their own timber. As a result their timber is being kept to help them over the shortage that is surely coming and the farmer is ruining his woodland by indiscriminate and thoughtless cutting. When the era of higher prices arrives, the farmer will have little or no timber left to sell.

Plate IV—*Products of the Farm Woodland. Natchitoches Parish.*

In selling timber there are six points to be remembered:

1. Mark carefully the trees that should be cut.
2. Obtain from different buyers the prices paid for this class of material and their specifications.
3. Decide which market will give the largest profit.
4. Have a written agreement with the buyer.
5. Cut and haul your own timber.
6. Insist that a fair rule be used to measure your timber.

There is no profit in cutting small trees for sawlogs. For instance, it costs $2.07 to fell 1000 boardfeet of timber from 8 inch trees, while it only costs $1.40 to fell 1000 boardfeet from trees 12 inches in diameter.* In addition the expense of hauling small logs is higher, and the price paid is smaller. Logs are purchased on grade, and as a rule the smaller logs are of lower grade. There

KEEP SMALL TREES FOR A CONTINUOUS INCOME

Morehouse Parish Farmer Sells No Trees Under 8 Inches From His 83 Acre Woodland

For The Timber Sold

In 1912 He Received - - - -	$ 700
In 1927 He Received - - - -	$1,600

Today he still has a good stand of young trees.

PLATE V—*Eighteen Year Old Shortleaf Pine Stand Following Cutting For Pulpwood. Twenty Cords Were Removed Per Acre. Good Stand of Small Trees Left. Ouachita Parish.* (Photo by U. S. Forest Service)

can be little profit if labor costs eat up most of the price received for the timber.

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* "Profit or Loss in Cutting Shortleaf and Loblolly Pines in Alabama"—Page 46, Table No. 22, Bulletin No. 2, Alabama Commission of Forestry, Montgomery, Alabama.

In marketing the farmer should find out which market offers the best return for his timber as the margin between profit and loss is often very small. A frequent mistake is the failure to realize that different sized logs require different markets. As a rule pulpwood cannot be profitably cut from large trees as the expense of splitting is entirely too great.

CORDWOOD FROM LARGE TREES DOES NOT PAY

Morehouse Parish Farmer Sold All Trees For Pulpwood

Included were many large trees
One Tree Measured 23 Inches At The Stump
And 90 Feet High

As Pulpwood It Cut	1 Cord
Stumpage Value at $.50 per cord	$ .50
As Lumber It Scaled	435 Bd. Ft.
Stumpage Value at $4.00 per M	$1.75
Loss When Sold For Cordwood	$1.25

It pays the farmer to cut and haul his own timber. The cotton farmer picks his own cotton and hauls it to the gin. He should use the same labor, cut his own timber and haul it, using the same teams or trucks. By so doing he can profitably employ labor and teams that would otherwise be idle.

Use the whole tree. Frequently several cords of valuable wood are left to rot on the ground due to carelessness. The cost of cutting it into posts or cordwood is not great and the yield from timberland can be increased by careful supervision of the cutters. Estimates show that about 30% of the wood that grows is left in the woods. By reducing this percentage, the farmer can often obtain a profit rather than a loss.

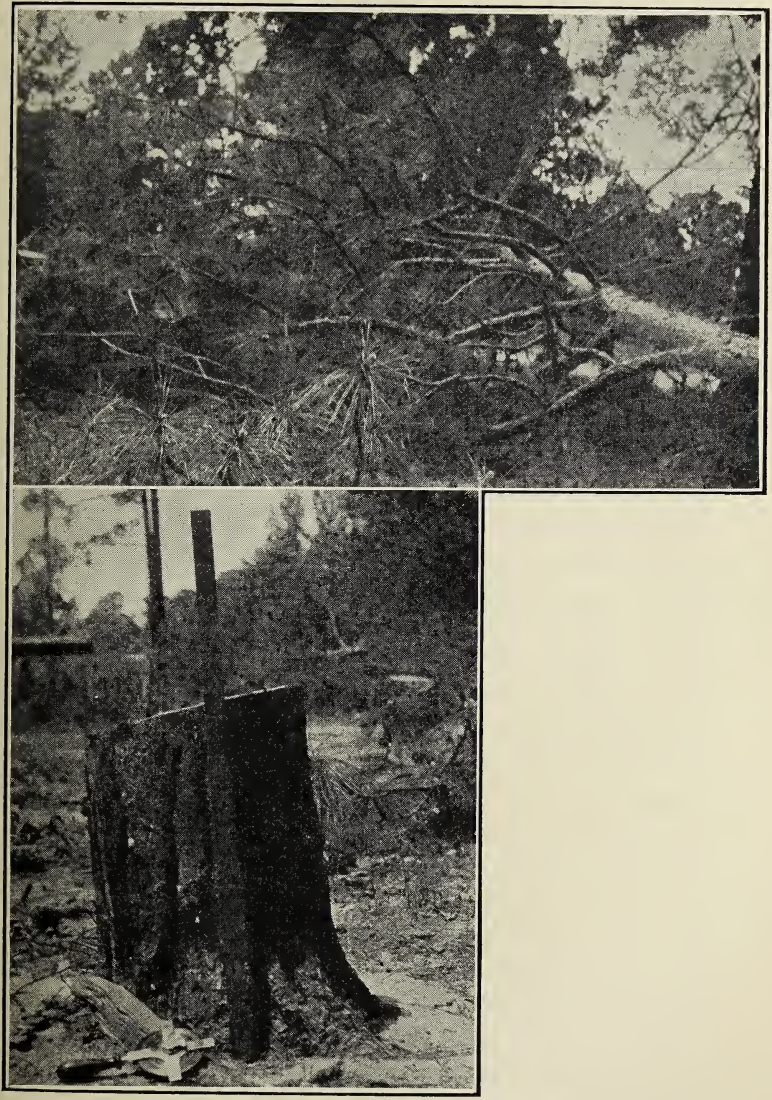

PLATE VI—*Poor Utilization. Much Good Lumber Left in Stump and Top. Rapides Parish.*

USE THE ENTIRE TREE

Natchitoches Parish Farmer Cut Trees For Posts

From Six Trees

He Sold - - - - - -	10 Posts
He Left In The Tops and Stumps - -	14 Posts

DOES POOR UTILIZATION PAY?

SUMMARY

1. Louisiana farmers own over three million acres of potential forest land. Most of it is poorly handled but could, with proper care, yield a continuous income and in addition supply the farmer with all the fuel and timber he needs.
2. The loblolly and shortleaf pines, because of their usefulness and rapid growth, offer excellent opportunities to the farmer for timber growing.
3. Fires should be kept out of the forests at all times.
4. Natural reforestation is recommended for with proper handling artificial methods are not often necessary.
5. When cutting, leave at least two loblolly or shortleaf pine trees per acre as seed trees for the future stand. These trees should have good crowns and be 10 inches or over in diameter at 4½ feet from the ground.
6. Sawlogs should be the final aim of the farmer. Pulpwood, posts, and fuelwood can be secured from thinnings which should be made as often as the stand becomes crowded.
7. In marketing timber, mark those trees which should be cut and secure the best market possible for this material.
8. The farmer should cut and haul the timber himself when his labor and teams are not otherwise employed.
9. Utilize the entire tree.
10. When in doubt as to what to do, write the Extension Forester, Louisiana State University, Baton Rouge, or the State Forester, New Orleans, Louisiana.

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LOUISIANA CORN VARIETIES

BY

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AND
AGRICULTURAL AND MECHANICAL COLLEGE
AGRICULTURAL EXPERIMENT STATIONS

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LOUISIANA CORN VARIETIES

By H. B. BROWN

IMPORTANCE OF THE CORN CROP

Corn is the most valuable crop grown in the United States. 2,839,959,000 bushels were produced in 1928 and the average annual production from 1920 to 1927 inclusive was 2,862,041,000 bushels. This was more than 60% of the corn grown in the world during the time and it had an annual value of approximately $2,000,000,000.

The Louisiana corn crop in 1928 was 21,114,000 bushels, and the 1929 crop is estimated at 20,348,000 bushels. This is 18.2 bushels per acre. Iowa, the leading corn state, made an average of 42.6 bushels per acre in 1928. Our yield seems low when compared with Iowa's but it is not low in comparison with the yield of the Southern states where corn growing conditions are not so favorable as are to be found in the Corn Belt.

The question may arise as to whether or not it is best to try to grow corn where the yields are so low. Probably it will not pay to grow corn to sell but it will pay to grow feed for home use. Corn is one of the valuable food crops. It has an important place in the farm organization. It fits in well in rotations; low lands not fit for cotton, the cash crop, may be planted in corn late in the season and make a crop; corn adds to the variety of crops on the farm and provides work when the labor on the place might have nothing to do otherwise. The corn yield per acre in Louisiana might be increased considerably if more attention were given the crop. If better land were planted to corn, more use made of fertilizers and legumes, and the corn cultivated when it needs cultivation, much better yields could be made. It is not a difficult matter to make from 30 to 50 bushels of corn per acre in Louisiana. Such a yield is certainly more profitable than 11 to 18 bushels.

Unless a good crop is made, as one writer has put it, the cribs will be empty and if the cribs are empty the livestock is apt to be empty too. If the farmer attempts to buy feed his pocketbook is likely to be empty also. Feed is costly if you have to buy it, especially if it is shipped in from the North. Corn seems to be very costly if you have to buy it when money is scarce. According to the 1920 census over 12 million dollars worth of feed was purchased by Louisiana farmers in 1919. This evidently made a big hole in the profits made from sale of the cash crops that year. Much feed is shipped in every year. It is poor economy to buy so much feed. Stock would be better fed and the farmer more prosperous if more of the feed needed on the farm were grown at home.

METHODS OF CORN IMPROVEMENT

Corn has been grown in the United States since the date of the first settlement and more or less effort put forth to improve it. The methods of improvement, or breeding, have embraced mass selection, plant to row testing, crossing of different varieties, and more recently, selection in inbred lines followed by crossing.

Mass selection has been in use the longest and has, in general, given best results. Most of our best varieties of corn have been produced by mass selection continued through a series of years. Mass selection, as is probably known by many, consists simply in taking ears from a large number of stalks that are of the type desired and shelling them together for planting seed. Since most corn varieties contain many more or less distinct forms and are not altogether uniform it is possible to shift the type, or change it to some extent in almost any way desired, unless it is in increasing production. It is difficult to do that. All that is necessary to make the other changes mentioned is to have a definite ideal in mind and hold to it closely for a series of years, when making selections.

About 1890 the Illinois Experiment Station and some other stations began using ear to row testing as a method of corn improvement. This method seemed to give good results at first but the limit of improvement was soon reached. Many experiment stations tried to improve their corn by using this method without much success. Starting with a mixed variety it was possible, in some cases, to isolate a desirable strain, but further improvement was not attained as a rule.

A little later it was learned that crossing strains of corn had a tendency to increase their yielding powers. Several experiment stations conducted rather extensive experiments in which various commercial varieties were crossed by planting them in alternate rows and detasselling every other row. These experiments showed increases for the hybrid strains in most cases but the increase was not outstanding—hardly enough to pay for the extra trouble of making the cross.

In 1909 the use of selection within pure lines of corn was suggested by Shull as a means of corn improvement. According to the plan pure line strains are obtained by inbreeding or self pollinating stalks within a variety for some years and then making selections in the best selfed strains. These selected strains are subsequently crossed. It has been found that the first generation plants following the cross are much more productive and vigorous than the parent strains which had been inbred and are in most instances more productive than the original variety of corn. While this method of corn breeding has given some rather phenomenal results on experimental plats it has never come into extensive use in a practical way. The main reason that it is not being used by the practical corn grower is that it is considered too much trouble to get the crossed seed to plant. The seed from the crossed plants gives first generation plants that are very productive but seed from these plants produces less productive plants. The peak of production appears only in the first generation hybrid plants. Considerable effort is being put forward at present by different experimenters to devise some simple way of using the inbreeding method.

CORN IMPROVEMENT IN LOUISIANA

Considerable interest has been taken in corn improvement work in Louisiana for many years. A Corn Growers Association, whose chief interest was that of improving the corn grown in the State, was organized in 1909. The Experiment Station has made studies of the adaptation of many varieties of corn that have appeared.

In 1923 corn breeding work in cooperation with the Office of Cereal Investigations, Bureau of Plant Industry, Washington, D. C., was started with Hugo Stoneberg, Corn Investigation Specialist, in immediate charge. This work has been of a somewhat technical nature and has had to do mainly with the effect of selection in self fertilized lines. Selfed strains have been obtained which differed from each other in respect to susceptibility to various diseases—ear, stalk, and root rots, physoderma, and rust diseases; height of plant, length and shape of ear, quality of husk protection, and number of ears per plant; number of kernel rows on the ear, and size and density of kernels; strength of stalk and non-lodging ability; and various abnormalities of leaves and stalks.

Numerous crosses between selfed lines have been made each year. These crosses have been grown in comparison with a local variety to test their relative yielding abilities, and the efficiency of the husk protection to prevent weevil damage. A few high producing crosses have been obtained some of which yielded as well or better than the best local variety and had in addition more uniformity non-lodging ability, and better husk protection. However, up to the present time no strain has been secured that is very outstanding. Consequently no steps have been taken to bring the new strains into quantity production. No seed is available for distribution.

RECENT VARIETY STUDIES*

Recently a number of corn variety tests have been conducted in various parts of the State in an effort to find out what varieties are best suited to different soil types. At Baton Rouge, tests have been conducted on both Bluff and Alluvial Lands since 1925. Extensive experiments over the State were started in 1929. Seed of ten of the most prominent varieties of corn grown in the State was obtained from the originators of the various varieties, or from other reliable sources and planted in well planned tests. Plats were carefully prepared and enough replications used to make results reliable. No effort was made to secure phenomenal yields by heavy fertilization or otherwise. It was thought that tests made under the normal conditions of corn growing in the State would be worth more to the growers than if made under more ideal conditions.

Soybeans were planted in the corn rows at the time the corn was planted in all the tests except at Homer and Calhoun. While soybeans planted in corn in this way injure the current crop to some extent it is unquestionably a good practice for most areas in the State because of the increased fertility the beans give the soil.

In 1929 tests were conducted at Dixie and Melrose in the Red River valley, at Homer and Calhoun on North Louisiana Hill Land, near Monroe in the Ouachita valley, near Thibodaux and near Raceland on South Louisiana Alluvial Land, at Lafayette on Prairie Land, at DeRidder on Pine Hill Land, at Hammond on

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*The corn variety work from 1925 to 1928 was in charge of A. F. Kidder and Hugo Stoneberg. John Gray supervised the cooperative tests in 1929. The Experiment Station is greatly indebted also to growers over the State who cooperated in this work.

Pine Flat Land, at Baton Rouge on Bluff Land and also on rather low Alluvial River Land.

VARIETIES TESTED

Since some of our readers may not be acquainted with all of the varieties used in the tests it may be well to give a brief description of each.

Hastings' Prolific. This variety was developed and is being grown by the Hastings' Seed Co. of Atlanta, Georgia. Plants are large and medium late. Under favorable conditions two or more ears are produced on a stalk. Ears are small and tapering, 7 to 8 inches long, and 5¼ to 5¾ inches in circumference. Kernels are grayish white and dented moderately. Percentage of grain is about 88.

Cocke's Prolific. Cocke's Prolific corn originated in Virginia more than a hundred years ago. From there it spread over much of the South. J. B. Allen of Port Gibson, Mississippi, made selections in a strain of this variety that found its way into the Mississippi-Yazoo Delta. The writer procured seed of this variety from Mr. Allen in 1915. Cocke's Prolific is similar to Hastings in earliness and habit of growth. It commonly produces two or more ears per stalk if the growing conditions are good. The ears are medium small, somewhat larger than the Hastings' ear, and more nearly cylindrical. The kernels are grayish white in color and dented but slightly. Most of the ears appear to be rather smooth and flinty due to the prevalence of horny endosperm in the kernel. The percentage of grain is about 86.

Whatley. This variety was originated by the Whatley Bros. of Helena, Georgia. In general the variety resembles Hastings but has slightly smaller, smoother, and less tapering ears. The kernels are white but the cob is red. This is a very prolific variety.

Yellow Creole. Yellow Creole has been grown in Louisiana for many years. It probably came from Central or South America originally. This is also a medium late, large growing, prolific variety. The ears are smooth, long, and slender, with short, rounded, yellow, flinty kernels. The percentage of grain is about 80. This variety is more weevil resistant than any other used in the test, due probably to better husk protection and more flinty kernels.

Calhoun Red Cob. This variety originated near Calhoun, Louisiana, about fifty years ago and has been a popular variety over much of the State. It has been well liked, probably, due to the large cylindrical ear. The stalks are somewhat smaller than those of the other varieties mentioned above and bear but one ear as a rule. The ear is large, rough and cylindrical with deep narrow, yellow or white kernels. The percentage of grain is high. In recent tests this variety has ranked rather low in yield.

Calhoun White. This is simply a white strain that was selected from the above variety. Except for color of grain the two are very similar.

Sentell's White Dent. This variety was developed by J. M. Sentell of Dixie, Louisiana through mass selection practiced for several years. This is a one-ear variety with rather large, slightly tapering, cylindrical ears. The kernels are white, rather long, but not deeply dented. The percentage of grain is high. In most of the recent tests this variety has made the best yield of the one-ear varieties. It appears to be the best non-prolific variety for the northern part of the State.

Stewart's Yellow Dent. This variety was originated by N. W. Stewart of Plain Dealing, Louisiana, by means of mass selection. This is a non-prolific variety which has a rather short, thick ear with a high percentage of grain. The kernels are yellow and have a tendency to be rough on the outer end.

Surcropper. Surcropper is a Texas variety which is being distributed by the Ferguson Seed Company. Stalks are medium sized, less growthy than most of the varieties mentioned above, and earlier by several days. Ears are medium short and thick and commonly but one to the stalk. The percentage of grain is medium low and the rank in yield in recent tests is not high.

Imperial White. This variety is of the Laguna or Mexican June type and is grown rather extensively in south Louisiana. It is a late variety and produces a very tall and heavy stalk. It is probably the best silage corn in the list of varieties mentioned. The ear is rather short and thick with large, moderately soft kernels. The percentage of grain is moderately low. The yields were fairly good the past season in several tests in the southern part of the State.

BLUFF LAND TEST AT BATON ROUGE

The land used in the 1929 Bluff Land test at Baton Rouge is a silt loam soil of medium fertility. It was in corn the previous year. There were 150 lbs. of nitrate of soda per acre used as a side dressing when the corn was about knee high. The corn and beans were planted April 8 and nearly a perfect stand of both was secured. (See Fig. 1). Except for slight injury to young plants by birds the corn grew to maturity without mishap and made a fair crop. It will be observed by referring to Table I that the variation with respect to yields of different varieties was not very wide but there are some differences that are significant. Hastings' Prolific, Cocke's Prolific, Whatley's Prolific, and Yellow Creole are leaders in yield. Table II shows that these same varieties have ranked high in tests conducted on this land each year since 1925 and are evidently good varieties for the region.

Fig. I. Corn Variety Test at Baton Rouge in 1929. Note the heavy growth of soybeans in the corn.

TABLE I

LOUISIANA CORN VARIETY TESTS IN 1929

Comparative Yield per Acre in Bushels.

Variety	Melrose	Dixie	Homer	Monroe	La. Training Inst. Monroe	Thibodaux	Raceland	Lafayette	DeRidder	Hammond	Bluff Land Baton Rouge	Alluvial Land Baton Rouge	State Normal Natchitoches	Av. Rank over State
1. Yellow Creole	16.4	22.2	5.8	31.6	27.2	16.0	44.8	19.3	14.1	6.8	29.9	28.5	62.8	4
2. Cocke's Prolific	18.8	31.0	14.9	36.2	24.6	12.7	42.3	16.4	14.3	7.7	32.0	29.3	62.5	1
3. Hastings' Prolific	18.6	28.4	11.9	29.2	23.8	10.6	34.3	17.0	16.8	8.4	34.1	23.6	62.9	2
4. Whatley's Prolific	18.2	27.8	10.5	28.4	21.0	10.9	38.6	18.1	17.1	8.3	31.4	28.4	53.5	3
5. Calhoun Red Cob	11.4	16.1	9.1	25.9	20.8	11.7	20.1	13.6	14.5	5.4	27.6	20.7	41.0	7
6. Calhoun White	10.0	21.8	4.9	25.8	21.8	9.3	29.3	12.5	12.8	5.0	26.7	21.2	46.8	10
7. Surcropper	13.6	19.3	11.6	25.1	17.4	7.5	28.8	13.0	14.0	5.9	27.0	17.8	39.5	9
8. Sentell's W. Dent	17.9	25.6	7.6	34.5	24.1	6.3	31.0	15.3	14.8	6.5	24.6	27.6	56.0	5
9. Stewart's Y. Dent	11.9	24.7	9.5	27.4	19.1	8.7	17.5	10.8	14.3	4.7	25.6	19.0	47.5	8
10. Imperial White	15.9	16.6	3.1	24.5	26.7	15.1	28.5	24.4	10.8	6.4	28.6	28.2	63.5	6
11. Hill's Y. Dent*							51.7				30.9	26.4		

* Planted at Raceland and Baton Rouge only. Was grown without soybeans at Raceland.

TABLE II

Corn Variety Tests at Baton Rouge, La.
1925-1929

Bluff Land

Variety	1925	1926	1927	1928	1929	Av. Rank, '25-'29
Calhoun Red Cob	38.4	37.1	46.1	51.1	27.6	8.6
White Calhoun	36.9		48.4		26.7	8.3
White Creole	33.8	32.0	45.0			11.3
Yellow Calhoun	32.2					
Yellow Creole	39.0	36.8	53.1	55.5	29.9	6.8
Mosby	46.0	47.7	48.5	58.6		4.5
La. Cocke's Prolific		47.7	54.2	63.4	32.0	2.5
Delta Sta. Cocke's Prolific	48.4	44.6	53.2	64.6		2.2
Whatley's Prolific	46.8	46.8	53.5	67.7	31.4	2.6
Hastings' Prolific	43.2	37.6	55.9	66.8	34.1	3.4
Garrick	39.7					
Delta Prolific		51.9	46.3	59.3		4.6
Sentell's W. Dent					24.6	
Imperial White	34.1	34.5			28.6	9.0
Adam's Paradise	44.7	40.6	44.1	53.6		8.2
C. I. No. 220 x 218		44.9	44.9	54.1		8.3
Corn Inve. ADEC			45.2			
Hill's Yellow Dent					30.9	
Surcropper					27.0	
Stewart's Y. Dent					25.6	

TABLE III

Corn Variety Tests at Baton Rouge, La.
1925-1929

Alluvial Land

Variety	1925	1926	1929	Av. Rank '25-'29
Calhoun Red Cob	25.7	30.4	20.7	10.0
White Calhoun	21.6	....	21.2	9.5
White Creole	36.1	36.0	....	7.5
Yellow Calhoun	15.9	....	....	....
Yellow Creole	33.0	41.6	28.5	5.0
Mosby	36.7	42.4	....	4.0
La. Cocke's Prolific	....	42.8	29.3	1.5
Delta Sta. Cocke's Prolific	44.3	40.5	....	3.5
Whatley's Prolific	41.1	41.9	28.4	3.0
Hastings' Prolific	40.7	50.5	23.6	3.6
Garrick	33.1	....	....	....
Delta Prolific	....	38.5	....	....
Sentell's W. Dent	....	....	27.6	....
Imperial White	39.9	39.8	28.2	5.0
Adam's Paradise	31.0	31.6	....	9.5
C. I. No. 220 x 218	....	24.1	....	....
Hill's Yellow Dent	....	....	26.4	....
Surcropper	....	....	17.8	....
Stewart's Y. Dent	....	....	19.0	....

TABLE IV

LOUISIANA CORN VARIETY TESTS IN 1929

Comparative Rank of Varieties in Different Tests

Variety	Melrose	Dixie	Homer	Monroe	La. Training Inst. Monroe	Thibodaux	Raceland	Lafayette	DeRidder	Hammond	Bluff Land Baton Rouge	Alluvial Land Baton Rouge	State Normal Natchitoches	Av. Rank
1. Yellow Creole	5	6	9	3	1	1	1	2	7	4	4	2	3	4
2. Cocke's Prolific	1	1	1	1	3	3	2	5	5	3	2	1	4	1
3. Hastings' Prolific	2	2	2	4	4	6	4	4	2	1	1	6	2	2
4. Whatley's Prolific	3	3	4	5	7	5	3	3	1	2	3	3	6	3
5. Calhoun Red Cob	9	9	6	7	8	4	10	7	4	8	6	9	9	7
6. Calhoun White	10	7	7	8	6	7	6	9	9	9	8	8	8	10
7. Surcropper	7	8	3	9	10	9	7	8	8	7	7	10	10	9
8. Sentell's W. Dent	4	4	8	2	5	10	5	6	3	5	10	5	5	5
9. Stewart's Y. Dent	8	5	5	6	9	8	9	10	6	10	9	7	7	8
10. Imperial White	6	10	10	10	2	2	8	1	10	6	5	4	1	6

ALLUVIAL LAND TESTS AT BATON ROUGE

The land used in this test is rather low river land which is classed as Sharkey clay loam and is of medium fertility. The corn and beans were planted April 5 and a good stand obtained. Wet weather interfered with the growth of the plants for a time after they came up. After the land became dry enough to plow a side dressing of 150 pounds per acre of nitrate of soda was applied. This revived the small yellow plants and a fairly good crop was made. By looking at Table I, it may be noted that about the same varieties ranked high here as in the Bluff Land test.

LAFAYETTE

The Lafayette test was made on moderately fertile prairie land about 1 mile west of the town of Lafayette. The corn was planted with soybeans in the row April 18. The stand obtained was only fair. Birds and farm stock damaged the corn considerably as it approached maturity. Stalk counts were made and allowance figured for the damage done but the results are probably not very reliable. Imperial White ranked first in yield. There was a good stand of this variety. Stalks stood up well and bore good ears. Ranking next to this variety was Yellow Creole which in turn was followed by the other prolific varieties.

RACELAND

The Raceland test was made on Alluvial Land of the Sharkey clay type about five miles southwest of Raceland in LaFourche Parish. The land was fairly rich. No fertilizers were used. The corn and beans were planted April 3. The germination of the corn was good. The thinning was not well done, too many stalks being left in a hill in some rows. The beans were not planted very uniformly apparently. Some rows had many more plants than others. Hill's Yellow Dent appeared to be outstanding in yield. It had some advantage in that no beans were planted in the rows of this variety. It is probably well adapted to the region, however, since it was developed there.

THIBODAUX

The Thibodaux test was conducted on Alluvial Land ten miles southeast of Thibodaux. This land was similar to the land used at Raceland but not quite as low nor as fertile. No fertilizers were used. The corn was planted April 3. The stands obtained were not very uniform and probably the cultivation was not sufficient for best yields. The yields were rather low due in part to the fact that the rows were 5½ feet apart. Imperial White and Yellow Creole made the best showing. Both of these varieties have been generally considered well adapted to the Thibodaux section of the State.

DE RIDDER

The test at DeRidder was on ridge land about ten miles west of DeRidder in Beauregard Parish. This land is not very productive naturally and as no fertilizer was used in the corn variety test, the corn plants did not become very large and the ears were rather nubbiny. The corn was planted April 12. Good stands were secured but yields were light due to infertile soil and dry weather. The results obtained are probably not very significant.

NATCHITOCHES

The test at Natchitoches, which was under the supervision of Prof. A. A. Fredericks, was made on land belonging to the State Normal College and located in the Cane River bottoms near the city. The land used was rather fertile due to legumes that had been grown previously. The yields are especially good, Imperial White being in the lead. It is followed closely by three of the prolific varieties.

MELROSE

The Melrose test was conducted on Cane River land located about 18 miles southeast of Natchitoches. This land was similar to the Normal College land mentioned above but not as fertile. The corn was planted April 11 and a good stand obtained. Yields are only moderate. The most significant thing to be noted in the results shown in Table I is the high ranking of the prolific varieties.

DIXIE

The Dixie test was conducted on the lighter type of Red River valley soil about fifteen miles north of Shreveport. No fertilizer was used but the land was fairly fertile. The corn was planted April 10. Fair to good stands were obtained. Yields are moderately good. The prolific varieties appear to be the best producers.

HOMER

The Homer test was made on North Louisiana Hill Land, about four miles south of Homer in Claiborne Parish. This land is naturally rather infertile but the owner has grown legumes, turned under cover crops, and used commercial fertilizers to such an extent that his land is fairly productive. A good stand of corn was secured but the yields are very low due principally to protracted dry weather during the spring and summer.

MONROE

The Monroe variety test was conducted on Ouachita valley soil of a light sandy loam type. The land is old land but has been well handled and is fairly fertile. No fertilizer was applied to this particular crop. The corn was planted April 8, and good stand secured. Yields are fairly good with Cocke's Prolific ranking first.

LOUISIANA TRAINING INSTITUTE

The Training Institute test was conducted on lands belonging to the Institute and located in the Ouachita valley near the city of Monroe. The soil was very similar to the soil where the Monroe test was conducted. The ranking of varieties in the two tests are similar in general.

ST. JOSEPH

A corn variety test was planted at the Branch Experiment Station farm at St. Joseph but was a failure on account of the extremely dry season.

HAMMOND

A corn variety test was conducted at Hammond on flat long leaf pine land. The land used was not very fertile naturally and no fertilizers were used. A period of dry weather that prevailed about tasseling time helped reduce yields. The planting was done April 17. Corn came up to a good stand. The yields are very low and the test probably not very reliable.

GENERAL CONCLUSIONS FROM THE TESTS

Most of the tests mentioned above have run but one year. One year, as is well known, is not a long enough period of time to give dependable data, yet, if the stand is good and the experiment well handled in every way the results have considerable significance. The large number of tests made increases the reliability of the data.*

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*This preliminary report of the corn variety tests is made at this time on account of the demand from growers and extension men for data on corn varieties adapted to the State. No publication on corn variety tests has been issued by the Experiment Station for a number of years.

Although the tests were widely distributed over the State and made under varied conditions there is considerable uniformity of results. In general, as may be seen from Table IV, varieties that ranked high in two or more tests ranked well all over the State. The four prolific varieties—Cocke's Prolific, Hastings' Prolific, Whatley, and Yellow Creole—ranked best on the average. It has been found by several other experimenters in the South that the prolific varieties of corn are more productive than the one-ear varieties and considerably more prolific than the early northern varieties which are sometimes planted for early feed.

The prolific varieties in the tests not only produced more grain but the corn was of a better quality, there being less ear rot and less weevil damage. It is sometimes argued that it is not best to grow the prolific varieties on account of their small ears which will make extra labor in gathering the corn. It is true that the ears are smaller but it will not cost more than two or three cents more per bushel to do the harvesting. This will not amount to more than a dollar per acre. The extra grain produced by the prolifics is worth several dollars per acre.

The different prolific varieties do not differ greatly in yield. The small differences shown in Table I are within the range of experimental error. Cocke's Prolific which made the best average in the tests over the State is perhaps preferable, not on account of its better yielding ability but on account of the fact that it has a slightly larger ear than the other prolific varieties tested.

Sentell's White Dent made the best showing, on the average, of the one-ear varieties. It is best adapted to the northern half of the State.

FERTILIZERS FOR CORN

The monetary value of the corn produced on an acre of land is ordinarily so low that the grower cannot afford to pay very much for fertilizers and expect to get a profitable return. The past season fertilizer experiments on corn were conducted on Bluff Land at Baton Rouge, and on Alluvial Land at Raceland and at Thibodaux. The soil used in these was similar to the soil on which the corn variety tests at the places named were conducted. It was the object of these fertilizer tests to find out what elements of a complete fertilizer are helpful to corn on land at the places named and how much could be used with profit.

TABLE V

Bluff Land Corn Fertilizer Test, Baton Rouge, La. 1929

Lbs. Fertilizer per Acre									
Plats	16% Nitrate of Soda	19% Super phos. (Acid phos)	45% Sul. of Potash	Formula	Wt. Ear Corn per Acre Lbs.	Increase over Average of Checks	Value of Increase (at $1 per bu)	Cost of Fertilizer	Profit or Loss 1929
1	150	0	50	12–0–11	1796	124	$1.77	$ 4.65	$–2.88
2	150	150	50	7–8–6	2004	332	4.74	5.85	–1.11
3	150	300	50	5–11–5	1997	325	4.64	7.05	–2.41
4	150	450	50	4–13–3	1972	300	4.29	8.25	–3.96
5	150	600	50	3–14–3	1959	287	4.10	9.45	–5.35
6	0	0	0	0–0–0	1783				
7	0	300	50	0–16–6	1888	216	3.09	3.45	– .36
8	100	300	50	4–13–5	1834	162	2.31	5.85	–3.54
9	150	300	50	5–11–5	1948	276	3.94	7.05	–3.11
10	200	300	50	6–10–4	2003	331	4.73	8.25	–3.52
11	250	300	50	7–10–4	1969	297	4.24	9.45	–5.21
12	300	300	50	7–9–3	2136	464	6.63	10.65	–4.02
13	0	0	0	0–0–0	1561				
14	150	300	0	5–13–0	1959	287	4.10	6.00	–1.90
15	150	300	25	5–11–5	1720	48	.69	6.53	–5.84
16	150	300	50	5–11–6	1767	95	1.36	7.05	–5.69
17	150	300	75	4–10–8	1724	52	.74	7.58	–6.84
18	150	300	100	4-10-10	1579	–93	–1.33	8.10	–9.43

TABLE VI

Cooperative Corn Fertilizer Test, Thibodaux, La., 1929

J. L. Blouin, Plantation owner; V. A. Guidroz, County Agent; and Louisiana Experiment Station, Cooperating.

	Fertilizer per Acre								
Plats	16% Nitrate of Soda	19% Super phos. (Acid phos.)	14% Kainit	Formula	Wt. Ear Corn per Acre Lbs.	Increase over Average of Checks	Value of Increase (at $1 per bu)	Cost of Fertilizer	Profit or Loss 1929
1	150	0	200	7–0–8	1686	300	$ 3.66	$ 5.20	$–1.54
2	150	150	200	5–6–6	1551	165	2.01	6.40	–4.39
3	150	300	200	4–9–4	1703	317	3.87	7.60	–3.73
4	150	450	200	3–11–4	1610	224	2.73	8.80	–6.07
5	150	600	200	3–12–3	1650	264	3.22	10.00	–6.78
6	0	0	0	0–0–0	1300				
7	0	300	200	0–11–6	1828	442	5.39	4.00	1.39
8	100	300	200	3–10–5	2152	766	9.34	6.40	2.94
9	150	300	200	4–9–4	2350	964	11.76	7.60	4.16
10	200	300	200	5–8–4	2396	1010	12.32	8.80	3.52
11	250	300	200	5–8–4	2224	838	10.22	10.00	.22
12	300	300	200	6–7–4	1894	508	6.20	11.20	–5.00
13	0	0	0	0–0–0	1472				
14	150	300	0	5–13–0	2383	997	12.16	6.00	6.16
15	150	300	100	4–10–3	2475	1089	13.28	6.80	6.48
16	150	300	150	4–10–4	2620	1234	15.05	7.20	7.85
17	150	300	200	4–9–4	2416	1030	12.56	7.60	4.96
18	150	300	250	3–8–5	2373	987	12.04	8.00	4.04

TABLE VII

Cooperative Corn Fertilizer Test, Raceland, La., 1929

The Ridgeland Company, Inc.; V. A. Guidroz, County Agent, and the Louisiana Experiment Station, Cooperating.

Plats	Fertilizer per Acre			Formula	Wt. Ear Corn per Acre Lbs.	Increase over Average of Checks	Value of Increase (at $1 per bu)	Cost of Fertilizer	Profit or Loss 1929
	16% Nitrate of Soda	19% Super phos. (Acid phos.)	14% Kainit						
1	150	0	200	7–0–8	4188	442	$ 5.53	$ 5.20	$ .33
2	150	150	200	5–6–6	4115	369	4.61	6.40	−1.79
3	150	300	200	4–9–4	4642	896	11.20	7.60	3.60
4	150	450	200	3–11–4	4379	633	7.91	8.80	− .89
5	150	600	200	3–12–3	4465	719	8.99	10.00	−1.01
6	0	0	0	0–0–0	3126				
7	0	300	200	0–11–6	3771	25	.31	4.00	−3.69
8	100	300	200	3–10–5	4261	515	6.44	6.40	.04
9	150	300	200	4–9–4	4156	410	5.13	7.60	1.47
10	200	300	200	5–8–4	4778	1032	12.90	8.80	4.10
11	250	300	200	5–8–4	4542	796	9.95	10.00	− .05
12	300	300	200	6–7–4	5354	1608	20.10	11.20	8.90
13	0	0	0	0–0–0	4365				
14	150	300	0	5–13–0	5391	1645	20.56	6.00	14.56
15	150	300	100	4–10–3	5291	1545	19.31	6.80	12.51
16	150	300	150	4–10–4	4315	569	7.11	7.20	− .09
17	150	300	200	4–9–4	4914	1168	14.60	7.60	7.00
18	150	300	250	3–8–5	4660	914	11.43	8.00	3.43

From Tables V, VI, and VII it may be seen that the fertilizers used nearly all gave an increase in yields but the increase was not sufficient in most instances to pay for the fertilizers. On poorer land the effect might have appeared to be greater. It is doubtful, however, if a complete fertilizer for corn will pay, especially on the better lands of the State.

In some corn fertilizer experiments carried on by the writer in Mississippi on sandy loam valley soil of medium fertility, 100 pounds of nitrate of soda, or other fertilizers bearing an equivalent amount of nitrogen, gave an increase of 8 to 10 bushels per acre. 200 pounds of nitrate of soda gave an increase of about 15 bushels per acre. These figures are in line with data obtained by several other investigators. A nitrogen fertilizer on corn will pay on most lands; 100 pounds of nitrate of soda or its nitrogen equivalent in some other nitrogen fertilizer will probably be the most profitable. The other fertilizer ingredients of a complete fertilizer are much less certain to give profitable returns.

PLANTING SOYBEANS IN CORN

A good way to get nitrogen into the soil is to grow soybeans in the corn. For them to make satisfactory growth, the beans must be planted at the time the corn is planted, especially if corn is planted in every row. Soybeans planted in the middle after the corn is laid by rarely do well.

Soybeans planted in the row of corn at the time the corn is planted make good growth—may even cover all the space between rows and appear to do about as well as if planted alone. They will injure the crop of corn in which they are planted to some extent—from about 10 to 30% as shown by tests, but they will yield a considerable tonnage of hay and perhaps add some nitrogen to the soil. If turned under the beans will add an extra supply of nitrogen to the soil, increase its supply of organic matter and put it in a better mechanical condition.

The amount of harm done by soybeans in corn to the current crop of corn varies considerably with the soil and season. If the land is poor and the rainfall scanty the injury is severe. It is probably better to plant the beans in separate rows alternating with the corn rows on this type of land. On fairly rich land where there is plenty of rainfall, the injury is much less. At Baton Rouge the past season the soybeans reduced corn yields 23.6%. Corn with beans planted in every row made 40.7 bushels per acre while plats with the same number of stalks of corn per acre but planted in rows alternating with rows of beans made 36.6 bushels, or about four bushels per acre less.

SUMMARY

1. Louisiana produces annually approximately 20,000,000 bushels of corn.

2. The yield is less than 20 bushels per acre, or about one-half the yield made in Iowa.

3. The yield per acre in Louisiana might be increased materially by planting better varieties, improving the soil, and using better cultural methods.

4. Mass selection is the most satisfactory method of corn improvement for the practical grower.

5. Inbreeding followed by selection and crossing pure lines is a technical method of corn breeding that may produce highly improved varieties in the future.

6. In variety tests made at Baton Rouge during the past five years, prolific varieties have led in yields both on Bluff and Alluvial Lands.

7. In thirteen variety tests conducted in different parts of the State in 1929, Cocke's Prolific ranked first, Hastings' Prolific second, Whatley's Prolific third, and Yellow Creole fourth. Sentell's White Dent yielded best of the one-ear varieties.

8. In three tests, in which complete fertilizers were used on corn, there was an increase in yield in most instances but the gain was not sufficient to be profitable in many cases. A nitrogen fertilizer usually gives profitable returns.

9. Soybeans in corn damage the crop in which they are planted more or less but they add nitrogen to the soil and have a renovating and beneficial effect. In general soybeans should be planted in every field of corn early in the season, and preferably at the time the corn is planted if planted in the corn row.

SOURCE OF SEED

1. Yellow Creole—La. Exp. Station, Baton Rouge, La.
2. Cocke's Prolific—La. Exp. Station, Baton Rouge, La.
3. Hastings' Prolific—H. G. Hastings Seed Co., Atlanta, Ga.
4. Whatley's Prolific—Whatley Bros., Helena, Ga.
5. Calhoun Red Cob—R. B. Harris, Cheneyville, La.
6. Calhoun White—I. L. Haile, Linville, La.
7. Surcropper—Ferguson Seed Co., Sherman, Texas.
8. Sentell's White Dent—Gulf States Seed Co., Alexandria, La.
9. Stewart's Yellow Dent—Gulf States Seed Co., Alexandria, La.
10. Imperial White—W. C. Simmons, Allemando, La.
11. Hill's Yellow Dent—Jos. B. Hill, Raceland, La.

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SUGARCANE VARIETY WORK
AT THE
TEST FIELDS

BY

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RAMIRES-JONES
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SUGARCANE VARIETY WORK AT THE TEST FIELDS

By

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INTRODUCTION

DURING the season of 1929 sugarcane variety work on the Experiment Station Test Fields was conducted on a more extensive scale than in 1927 and 1928. At each of the six test fields there was a plant cane field with the same nine varieties, in the replicated system of plots. At five of the test fields, eight varieties were on trial as first stubble; while at three of the places five varieties were under observation as second stubble. Under this arrangement, some comparative data and information on the field and mill behavior of the three field varieties, P. O. J. Nos. 36, 213 and 234, as plant cane, first stubble and second stubble during the past season has been obtained. In addition similar information was secured on 36M as plant cane and first stubble. This variety was released in time for the fall planting of the 1930 crop.

At the present stage of outfield sugarcane variety work, results are now available for two and three-year periods. The first year, 1927, was excellent; 1928 was fairly good; and 1929 which was very good from the standpoint of producing a bumper crop, but with its excessive rainfall and severe freezes during the harvesting period, proved very disastrous in the end. In Tables Nos. 15 and 16, the results and averages for two and three-year periods for the four field varieties have been compiled. These results are given in calculated pounds of 96° sugar, both by the ton and on the acre basis.

The results of the plant cane varieties furnish information for intervals before and after the freezes of late November and early December of the 1929 season. In addition giving comparative data on promising new seedling canes, planted for the first time on the test fields. These varieties will again be under observation in 1930, as plant cane and first stubble.

The Experiment Station test fields were used to very good advantage in disseminating information at field meetings and motorcades held at intervals during the season by County Agents. On such occasions the County Agents visited the test fields with groups of interested sugar planters, and inspected the sugarcane varieties growing under local conditions. The new seedlings, such as Co 281, C.P. 807, C.P. 130 and C.P. 177, were always of great interest to the visitors. In many cases planters returned at intervals during the season to observe the progress of these canes, in comparison with the proven field varieties: P.O.J. Nos. 36, 36M, 213 and 234.

SEASON OF 1929

The weather records for the first two and a half months of 1929 show excessive rainfall in all sections of the cane belt. At Meeker and Youngsville, there was less rain than in the river and Teche sections. The unfavorable weather retarded field work, and very little was accomplished until about the second week in March. There was so little opportunity before, and the stubble was so advanced in early March, that in a good many cases the cane was not shaved. The plant cane, which was very slow in coming out, was off-barred, scraped and worked.

The last half of March and all of April was light in rainfall, and excellent for cultivation and fertilization of stubble. During May the rainfall was heavy at all places except Glenwood and Sterling. The final cultivation operations were performed very early; in some cases early May, but mostly the middle of May to first of June. The plant cane was worked a few weeks longer.

The rainfall at the six test fields during the best growing months was as follows: (See Table A-1.)

Cinclare, Glenwood and Meeker had the best amounts and distribution of rainfall during this growing period. The July rains at Reserve and Sterling were quite excessive, and undoubtedly retarded the growth rate. At Youngsville the light August rainfall slowed down the rate of growth to a considerable extent.

The rainfall during the harvesting period was as follows: (See Table B-1.)

TABLE A-1—RAINFALL IN INCHES

Test Field	June		July		August		September	
	Days	Rainfall	Days	Rainfall	Days	Rainfall	Days	Rainfall
Cinclare	10	6.80	17	3.81	8	3.17	11	5.50
Glenwood	9	7.55	12	5.51	8	4.72	4	5.55
Meeker	6	2.30	11	6.18	3	3.27	4	3.07
Reserve	10	2.95	19	12.07	11	3.93	10	5.99
Sterling	8	9.25	12	12.82	7	3.43	7	4.40
Youngsville	3	3.46	11	5.26	3	1.11	10	5.95

TABLE B-1—RAINFALL IN INCHES

Test Field	October		November		December		Total Rainfall 1929
	Days	Rainfall	Days	Rainfall	Days	Rainfall	
Cinclare	6	12.39	12	17.26	6	4.74	84.89
Glenwood	4	8.16	6	5.34	4	1.64	69.18
Meeker	3	2.51	10	8.70	4	3.14	57.13
Reserve	8	6.46	14	7.19	6	2.25	75.43
Sterling	4	9.05	11	10.24	6	4.63	80.59
Youngsville	4	5.03	9	10.74	4	5.31	62.29

MINIMUM TEMPERATURES—(Degrees Fahrenheit)

Test Field	11-30	12-1	12-3	12-4	12-5	12-18	12-19	12-20	12-21	12-22
Cinclare	26	33	25	25	29	36	24	21	30	27
Glenwood	28	31	25	25	28	37	24	21	30	28
Meeker	23	31	22	23	28	32	21	20	26	24
Reserve	31	35	25	28	29	40	26	22	23	32
Sterling	30	35	26	25	29	38	24	22	31	24
Youngsville	26	34	24	24	29	35	23	21	30	27

MINIMUM TEMPERATURES—(Degrees Fahrenheit)

Test Field	12–23	12–24	12–25	12–26
Cinclare	23	25	31	33
Glenwood	24	..	..	..
Meeker	8	12	20	24
Reserve	26	26	33	33
Sterling	24	24	37	37
Youngsville	20	23	33	37

The important task of harvesting and milling the 1929 sugarcane crop started in most cases about October 15th. The rainfall records for October and November indicate the unfavorable weather conditions experienced in these two months. The month of November was particularly unfavorable, and from two to three weeks' time was actually lost in the fields and factories.

The first killing freeze on November 30th killed the bud of the cane throughout all sections of the cane belt, with exceptions such as in the Teche country, and portions of Terrebonne and Lafourche. The second and third freezes followed very closely on December 3rd and 4th, and all of the standing cane was completely killed throughout the cane belt. These freezes came at a time when on an average only 45 to 50% of the crop had been saved. Confronted with this serious situation, with half of the crop still in the fields, most of the planters made windrowing for the mill their chief activity for an interval of eight to ten days. During this time some of the factories operated under capacity, while others closed down completely to facilitate windrowing. The first four days following the freezes were very favorable for windrowing, as the temperatures remained fairly low, with intervals of clear and cloudy weather; but the next eleven days of warm weather were very unfavorable. During the interval of December 19-24, six severe freezes occurred, with heavy and unusual sleet and ice. From December 22-25, standing cane, trees, shrubs, etc., were heavily loaded with ice; while the sleet had penetrated through the windrows, making cracks and openings which exposed the cane to the adverse weather conditions, and hastened the rate of deterioration in the windrow.

After the severe freezes, the standing cane showed greatest deterioration about December 27th. The windrowed cane which was holding up well in the windrow up to the time of the sleet and ice, showed less deterioration than standing cane on December 27th. The rate of deterioration increased very rapidly in crooked P.O.J. 213, but much slower in P.O.J. 234 and 36. In some sections cane windrowed immediately after the early December freezes was milled with fairly good results until January 15th. In the Meeker section where the bud of the cane was completely killed by the first freeze of November 30th, the cane that was windrowed immediately afterwards, December 1 to 3, kept very well in the windrow, and showed very little deterioration at the time of milling on January 6 to 8, 1930.

FALL PLANTING OF 1930 TEST FIELDS

In order to have the sugarcane varieties on a plant cane basis at the six Experiment Stations test fields for the season of 1930, fall plantings were made from October 1 to 16, 1929. A total of eight varieties, including the four proven canes: P.O.J. Nos. 36, 36M, 213 and 234, and four promising seedlings: C.P. Nos. 130, 177 and 807, and Co 281 were planted in three row one-twentieth acre plots, checkerboard system, and five replications for each variety. The plantings were made in every case on the representative soil type of the section. In addition consideration was given to the matter of previous land treatment, that such was uniform, and in accordance with the Louisiana Experiment Station recommendation of having at least one crop of legumes, preferably soybeans, turned under before cane planting. These plant cane plantings on the test fields are primarily for the purpose of obtaining information pertaining to the characteristics of the varieties, field behavior and performance under existing conditions of the section, and field tonnages and chemical data at the end of the season.

In the large number of sugarcane seedlings that are under experimental observation at the Sugar Experiment Station, two varieties: C.P.H. 22 and Co 290, during the past few years have been making a very fine record. There was sufficient seed cane of these varieties to make introductory plantings at the six test fields. At these places they will be under observation throughout the season, and chemical tests will be made in the fall. If they prove to be sufficiently promising, these two seedlings will be included in the 1931 series of plant cane plots. Another promising variety, C.P. 766, was obtained in small quantities from the U. S. Sugar Plants Station at Houma, and also planted on the introductory basis.

The parentage of the promising new varieties now planted on the test fields is as follows:

C. P. 130: Okinawa-Tekcha X F. M. 3.
C. P. 177: Kassoer X F. M. 3.
C. P. 766: U. S. 1652 (seedling of P. O. J. 213).
C. P. 807: U. S. 1643 (seedling of P. O. J. 213).
C. P. H. 22: D-74 X U. S. 785.
Co 281: P. O. J. 213 X Co 206.
Co 290: Parentage unknown; of Indian origin.

EXPERIMENT STATION TEST FIELDS

The six Experiment Station test fields are located in the following representative sections of the cane belt:

(1) Cinclare: Located on the west side of the Mississippi river, Baton Rouge area, representing Mississippi river alluvial soil.

(2) Meeker: In the central portion of the state, representing Red river alluvial soil, and also northwest end of cane belt.

(3) Glenwood: Located on west side of Bayou Lafourche near Napoleonville, and representing Mississippi river alluvial soil.

(4) Reserve: Located on the west side of the Mississippi river, about half way between Baton Rouge and New Orleans; representing Mississippi river alluvial soil.

(5) Sterling: Located near Franklin on Bayou Teche, and representing soils of Teche section.

(6) Youngsville: Located near Youngsville in the parish of Lafayette; representing Olivier silt loam soils and the western section.

In presenting the results of the work conducted at these test fields, each place will be discussed under the respective test field heading. In all cases the results are for the season of 1929.

CINCLARE TEST FIELD

The Cinclare test field is located in the parish of West Baton Rouge, on the Mississippi river, and on Cinclare-Addition Plantation of Est. Harry L. Laws, Cinclare, La. The soil type is very fine sandy loam (first bottom soil). The variety work during the season of 1929 was conducted on two fields: (1) First Stubble: Planted Oct. 13-15, 1927; harvested Nov. 22, 1928, and Nov. 20-21, 1929. (2) Plant Cane: Planted Oct. 17, 1928, and harvested Nov. 20-21, 1929.

The average results of field and chemical data for these two fields follow. Table No. 1, for First Stubble, and Table No. 2, Plant Cane.

TABLE NO. 1

Cinclare First Stubble

Variety	Normal Juice			Tons Per Acre	Lbs. 96° Sugar	
	Brix.	Sucrose	Purity		Per Ton	Per Acre
P. O. J. 36	15.04	12.64	84.01	33.44	182.47	6101.79
36M*	16.11	11.73	72.87	25.60	156.04	4994.62
P. O. J. 213	15 14	12.14	80.19	36.00	170.84	6150.24
P. O. J. 228	14.14	11.34	80.23	29.72	159.63	4744.20
P. O. J. 234	15.72	11.29	71.85	26.20	148.75	3897.25
P. O. J. 826	13.94	11.16	80.05	31.69	157.00	4975.33
P. O. J. 979	15.24	9.64	63.28	30.36	115.65	3511.23
P. O. J. 2725	......	......	......	21.50	....	....
Purple	......	......	......	8.05	......	....
Striped	.....	.....	......	11.29	....	....

*36M—Windrowed Nov. 22, 1929 and milled January 8, 1930.

In field tonnage and sugar per acre yields, P. O. J. 213 is the leading variety; giving 2.56 tons per acre and 48.45 lbs. sugar per acre more than P. O. J. 36, second ranking variety. The latter, however, gave higher sugar per ton yield, in this respect, leading all varieties. The 36M was windrowed for planting purposes on Nov. 22, 1929, and taken up on January 8, 1930, and milled; remaining in the windrow for a period of 47 days. On this account it would be unfair to make variety comparisons with 36M. At the time of harvesting, P. O. J. Nos. 213 and 234 were lodging to a great extent; while P. O. J. 36 and 36M were erect.

TABLE NO. 2

Cinclare Plant Cane

Variety	Normal Juice			Tons Per Acre	Lbs. 96° Sugar	
	Brix.	Sucrose	Purity		Per Ton	Per Acre
P. O. J. 36	13.24	8.97	67.76	38.46	113.48	4364.44
36M	14.43	10.18	70.56	33.78	136.42	4608.26
36M**	14.45	9.95	68.41	30.55	126.74	3871.88
P. O. J. 213	12.93	8.84	68.35	42.27	112.54	4757.06
P. O. J. 234	14.52	11.38	78.38	32.06	158.18	5071.25
P. O. J. 2725	12.83	8.53	66.48	48.78	106.43	5191.65
C. P. 177	13.40	8.97	66.94	46.70	112.45	5351.41
C. P. 807**	13.74	7.66	55.82	43.20	....	....
Co 281**	15.02	10.27	68.44	41.54	130.81	5433.85

**36M—Windrowed Nov. 22, 1929, and milled January 8, 1930.

**C. P. 807—Windrowed Nov. 22, 1929, and milled January 8, 1930; the cane was so crooked that it was not protected in the windrow, being almost like standing cane.

**Co 281—Windrowed Nov. 22, 1929, and milled Jan. 8, 1930.

In field tonnage, P. O. J. 2725 is leading, giving 6.51 tons per acre more than P. O. J. 213. Co 281 gave the highest sugar per acre yield, giving 82.44 pounds per acre more than C. P. 177 and 242.30 pounds more than P. O. J. 2725, P. O. J. 234 is the leading variety in pounds of sugar per ton; exceeding 36M, second ranking variety, by 25.76 pounds per ton and Co 281 by 27.37 pounds per ton. The cane on this plant cane field was still in a growing condition and immature at time of harvest. The land had received two crops of soybeans turned under, and in addition a heavy treatment of stable manure the year previous, when it was planted in corn and soybeans. The following varieties showed an extreme amount of lodging: P. O. J. 213, 234, C. P. Nos. 130, 177 and 807; while P. O. J. 36, 36M, P. O. J. 2725 and Co 281 were fairly erect.

MEEKER TEST FIELD

This test field is located in the northwestern section of the cane belt in the parish of Rapides, on Red river alluvial soil. The work is in cooperation with the Meeker Sugar Refining Company, Meeker, La. The plans for establishing a test field were made in the summer of 1928, and in the fall of the same year the field was planted according to the regular plan of the Experiment Station. All necessary seed cane was furnished by the Sugar Experiment Station at Baton Rouge, being shipped to Meeker by railroad.

The Meeker test field was planted on Oct. 22, 1928, and harvested on Dec. 13-14, 1929. It was harvested after the freezes of Nov. 30, and Dec. 3 and 4. On account of the condition of the cane after these freezes, the cane was topped back about six joints. The new varieties: C. P. Nos. 130, 177 and 807 and Co 281 were harvested, weighed and planted before the freezes. The average results of field and chemical data are presented in Table No. 3.

TABLE NO. 3

Meeker Plant Cane

Variety	Normal Juice			Tons Per Acre	Lbs. 96° Sugar	
	Brix.	Sucrose	Purity		Per Ton	Per Acre
P. O. J. 36	12.70	8.40	66.15	29.90	104.38	3020.96
36M	12.80	7.93	62.00	28.99	93.56	2713.40
P. O. J. 213	12.30	7.70	62.65	28.45	64.12	1824.21
P. O. J. 234	13.15	8.48	64.50	25.30	103.32	2614.00
P. O. J. 2725	12.60	8.68	68.90	30.50	112.00	3416.00
C. P. 130	No mill test		......	33.30	....	....
C. P. 177	No mill test		......	38.40	....	....
C. P. 807	No mill test		......	45.70	....	....
Co 281	No mill test		......	36.05	....	....

In field tonnages, C. P. 807, C. P. 177 and Co 281, are the leading varieties. In the four approved canes, P. O. J. 36 and 36 M are first; followed by P. O. J. 213 and 234. The chemical data show unusually low sucrose and purities for all varieties. P. O. J. 2725 gave the highest sugar per ton and sugar per acre yields; followed by P. O. J. 36. While 36M showed higher sugar per acre yield than P. O. J. 234, but less sugar per ton.

GLENWOOD TEST FIELD

The Glenwood test field is located in the parish of Assumption on Bayou Lafourche. It is in cooperation with Glenwood Sugars Inc., Napoleonville, La. The type of soil is very fine sandy loam (first bottom soil). During the past season the work was conducted on two variety fields: First Stubble, planted Oct. 17-19, 1927, and harvested Dec. 17-18, 1928, and Dec. 8, 1929; and Plant Cane, planted Oct. 26, 1928, and harvested Dec. 7, 1929. The average results of field and chemical data for first stubble are given in Table No. 4, and for plant cane, Table No. 5.

TABLE NO. 4

Glenwood First Stubble

Variety	Normal Juice			Tons Per Acre	Lbs. 96° Sugar	
	Brix.	Sucrose	Purity		Per Ton	Per Acre
P. O. J. 36	15.43	12.25	79.41	33.40	171.55	5729.77
36M	16.68	13.99	83.91	28.70	202.00	5797.40
P. O. J. 213	15.72	12.48	79.43	37.10	174.78	6584.33
P. O. J. 228	15.24	11.43	74.99	31.40	154.76	4859.46
P. O. J. 234	17.04	13.48	79.11	29.30	188.39	5519.82
P. O. J. 826	No mill test		......	30.50	....	....
P. O. J. 979	15.72	12.28	78.13	31.80	170.40	5418.72
Purple	13.85	10.48	75.66	4.90	142.67	698.08

In first stubble field yields, P. O. J. 213 is the leading variety; exceeding P. O. J. 36 by 3.70 tons per acre, 36M by 8.40 tons per acre and P. O. J. 234 by 7.80 tons per acre. In sugar per acre results, P. O. J. 213 is the highest; giving 854.56 pounds per acre more than P. O. J. 36, 786.93 pounds per acre more than 36M and 1064.51 pounds per acre more than P. O. J. 234. In sugar per ton results, 36M is the leading variety; giving 30.45 pounds per ton more than P. O. J. 36; 27.22 pounds per ton more than P. O. J. 213 and 13.61 pounds per ton more than P. O. J. 234. At time of cutting P. O. J. 213 and 234 lodged to a considerable extent; while P. O. J. 36 and 36M were erect. On account of the effects of the freezes of Nov. 30, and Dec. 3rd and 4th., the cane was topped back about four joints when harvested.

TABLE NO. 5

Glenwood Plant Cane

Variety	Normal Juice			Tons Per Acre	Lbs. 96° Sugar	
	Brix.	Sucrose	Purity		Per Ton	Per Acre
P. O. J. 36	13.59	9.92	73.01	33.24	132.09	4390.67
36M	15.04	11.67	77.62	32.95	161.35	5316.48
P. O. J. 213	13.79	10.09	73.22	37.52	134.61	5050.56
P. O. J. 234	15.09	11.84	78.48	28.92	164.70	4763.12
P. O. J. 2725	14.05	10.29	73.25	36.37	137.31	4993.96
C. P. 130	No mill test		......	31.20	....	....
C. P. 177	14.53	11.11	76.51	34.20	152.28	5207.97
Co 281	14.73	11.56	78.53	33.15	160.86	5333.51

In plant cane field tonnages P. O. J. 213 is the leading variety, outyielding C. P. 177 by 3.32 tons per acre; P. O. J. 36 by 4.28 tons per acre and 36M by 4.57 tons per acre. Co 281 gave the highest sugar per acre yield; giving 17.03 pounds per acre more than 36M; 942.84 pounds per acre more than P. O. J. 36; and 570.39 pounds per acre more than P. O. J. 234. In the sugar per ton yields P. O. J. 234 is the leading variety; giving 3.35 pounds per ton more than 36M; 32.61 pounds per ton more than P. O. J. 36; and 30.09 pounds per ton more than P. O. J. 213. The following varieties showed a considerable amount of lodging: P. O. J. 213, 234, C. P. 130 and C. P. 807; while P. O. J. 36, 36M and Co 281 were erect. On account of the effects of the freezes of Nov. 30, and Dec. 3rd and 4th., the cane was topped back about four joints at time of harvesting.

Foot Note: The 36M plant cane and first stubble plots of the Glenwood test field were windrowed on Nov. 24, 1929. The first cane windrowed plots were harvested and milled on Dec. 7, 1929; while the first stubble plots were harvested and milled on Dec. 9, 1929.

RESERVE TEST FIELD

The Reserve test field is located in the parish of St. John, on the lower Mississippi river. The work is in cooperation with the Godchaux Sugars Inc., Reserve, La. The soil type is Sharky silty clay loam. During the season of 1929, the variety work was conducted on three fields: Second stubble, first stubble and plant cane. The second stubble field was planted on Oct. 28, 1926; harvested Nov. 25-26, 1927, Nov. 8, 1928, and Oct. 24, 1929. The first stubble field was planted Oct. 28, 1927; harvested Nov. 27-29, 1928, and Dec. 13-14, 1929. The plant cane field was planted Oct. 25, 1928, and harvested Dec. 13-14, 1929. Complete results were obtained from the first and second stubble fields; while only partial results were obtained from plant cane. In the latter case, 40% of the plots had to be harvested in the month of September, as the land was sold to the Parish School Board for a school building site. As a result comparative weights and mill tests were obtained from only a portion of the plots, and only 36M and four of the new seedlings. In harvesting both plant cane and first stubble, the knives were lowered about seven joints on account of the frozen condition of the cane, as a result of the freezes of Nov. 30, Dec. 3rd and 4th. The average results of field and chemical data are given in the following tables: No. 6, second stubble; No. 7, first stubble and No. 8, plant cane.

TABLE NO. 6

Reserve Second Stubble

Variety	Normal Juice			Tons Per Acre	Lbs. 96° Sugar	
	Brix.	Sucrose	Purity		Per Ton	Per Acre
P. O. J. 36	14.37	10.33	71.89	28.15	136.20	3834.03
P. O. J. 213	13.34	9.32	69.87	29.60	120.68	3582.13
P. O. J. 228	13.69	9.23	67.42	25.31	116.33	2944.31
P. O. J. 234	14.71	10.95	74.44	13.89	147.61	2050.30
P. O. J. 826	16.30	12.71	78.00	21.90	Handmill	....
P. O. J. 979	14.95	10.54	70.44	22.84	136.95	3127.94
P. O. J. 2379	13.50	9.61	71.20	17.25	Handmill	....

In second stubble field yield, P. O. J. 213 is the leading variety; giving 1.45 tons per acre more than P. O. J. 36; 4.29 tons per acre more than P. O. J. 228 and 15.71 tons per acre more than P. O. J. 234. In sugar per acre yield, P. O. J. 36 gave best results; exceeding P. O. J. 213 by 251.90 pounds per acre, and P. O. J. 234 by 1783.73 pounds per acre. P. O. J. 234 gave highest sugar per ton yield; giving 11.41 pounds per ton more than P. O. J. 36; 10.66 pounds per ton more than P. O. J. 979 and 26.93 pounds per ton more than P. O. J. 213.

TABLE NO. 7

Reserve First Stubble

Variety	Normal Juice			Tons Per Acre	Lbs. 96° Sugar		% Acidity
	Brix.	Sucrose	Purity		Per Ton	Per Acre	
P. O. J. 36	14.25	10.24	71.86	37.80	134.94	5100.73	2.8
36M	15.42	11.69	75.81	34.60	159.36	5513.85	3.0
P. O. J. 213	14.24	10.54	74.01	39.30	141.56	5563.30	2.9
P. O. J. 228	12.93	10.70	82.75	37.40	153.26	5731.92	3.0
P. O. J. 234	14.40	10.73	74.51	29.70	144.77	4299.67	3.2
P. O. J. 979	14.50	9.96	68.69	36.90	127.23	4694.78	2.6
P. O. J. 2725	16.00	11.69	73.06	14.80	155.72	2304.65	2.2

In the first stubble field tonnage results at Reserve, P. O. J. 213 is the leading variety; yielding 1.50 tons per acre more than P. O. J. 36; 4.70 tons per acre more than 36M, and 9.60 tons per acre more than P. O. J. 234. In the released varieties, P. O. J. 213 gave the highest sugar per acre yield; giving 462.57 pounds per acre more than P. O. J. 36; 49.45 pounds more than 36M and 1263.63 pounds per acre more than P. O. J. 234; 36M gave the highest sugar per ton yield; giving 24.42 pounds per ton more than P. O. J. 36; 17.80 pounds per ton more than P. O. J. 213 and 14.59 pounds per ton more than P. O. J. 234.

TABLE NO. 8

Reserve Plant Cane

Variety	Normal Juice			Tons Per Acre	Lbs. 96° Sugar		% Acidity
	Brix.	Sucrose	Purity		Per Ton	Per Acre	
36M	13.76	10.19	74.05	33.00	137.04	4522.32	3.0
C. P. 130	15.31	11.51	75.17	16.80	156.09	2622.31	3.1
C. P. 177	14.24	10.17	71.47	22.60	133.54	3018.00	3.0
C. P. 807	13.66	9.66	70.71	38.60	125.93	4860.89	3.8
Co 281	15.07	11.29	74.91	27.60	152.78	4216.72	3.1

The results of the five plant cane varieties of the Reserve test field indicate that C. P. 807 gave the best field tonnage and sugar per acre returns; giving 5.60 tons per acre and 338.57 pounds sugar per acre more than 36M. Co 281 was third ranking variety. C. P. 130 gave the highest sugar per ton yield, followed by Co 281 and 36M.

STERLING TEST FIELD

The Sterling test field is located in the parish of St. Mary on Bayou Teche. The work is in cooperation with Sterling Sugars Inc., Franklin, La. The soil type is Sharkey loam. During the past season the work was conducted on three fields: Second stubble, first stubble and plant cane. The second stubble field was planted on Nov. 13, 1926; harvested Nov. 22, 1927, Nov. 14-15, 1928, and Dec. 12, 1929. The first stubble was planted on Oct. 19, 1927; harvested Dec. 31, 1928, to Jan. 1, 1929, and Dec. 12, 1929. The plant cane field was planted on Oct. 29, 1928, and harvested Dec. 13-15, 1929. All three fields were harvested after the killing freezes of Nov. 30, Dec. 3 and 4, 1929; and in harvesting the cane the upper seven joints were discarded. The average results of field and chemical data are given in the following tables: No. 9, second stubble; No. 10, first stubble and No. 11, plant cane.

TABLE NO. 9

Sterling Second Stubble

Variety	Tons Per Acre
P. O. J. 36	18.40
P. O. J. 213	16.55
P. O. J. 228	11.90
P. O. J. 234	7.55
P. O. J. 979	12.25
Purple	

In the Sterling second stubble field, only the field yields were checked. There was not enough cane of the different varieties to conduct the proper mill tests. P. O. J. 36 gave the highest tonnage; giving 1.85 tons per acre more than P. O. J. 213, and 10.85 tons per acre more than P. O. J. 234. The results of handmill analyses of Oct. 9, 1929, showed the three varieties running very close together; with P. O. J. 36 slightly higher than both P. O. J. 234 and 213.

TABLE NO. 10

Sterling First Stubble

Variety	Normal Juice			Tons Per Acre	Lbs. 96° Sugar	
	Brix.	Sucrose	Purity		Per Ton	Per Acre
P. O. J. 36	17.23	14.59	84.70	23.42	211.64	4956.60
36M	17.08	14.39	84.30	22.41	208.22	4666.21
P. O. J. 213	16.98	14.64	86.26	24.60	214.15	5268.09
P. O. J. 228	16.28	12.80	78.65	21.73	178.29	3874.24
P. O. J. 234	17.68	15.34	86.77	21.02	224.96	4728.65
P. O. J. 979	16.98	13.67	80.50	21.20	192.84	4088.21
P. O. J. 2725	14.98	11.07	73.88	18.12	148.47	2690.27
Purple	15.68	12.55	80.06	5.83	176.54	1029.22

In the Sterling first stubble field results, P. O. J. 213 is the leading variety. However, only yielding 1.18 tons per acre more than P. O. J. 36 and 2.19 tons per acre more than 36M, and 3.58 tons per acre more than P. O. J. 234. P. O. J. 213 is also the leading variety in sugar per acre yield; giving 311.49 pounds per acre more than P. O. J. 36; 601.88 pounds per acre more than 36M, and 539.44 pounds per acre more than P. O. J. 234. In sugar per ton yield, P. O. J. 234 showed up best; giving 13.32 pounds per ton more than P. O. J. 36; 16.74 pounds per ton more than 36M, and 10.81 pounds per ton more than P. O. J. 213.

TABLE NO. 11

Sterling Plant Cane

Variety	Normal Juice			Tons Per Acre	Lbs. 96° Sugar	
	Brix.	Sucrose	Purity		Per Ton	Per Acre
P. O. J. 36	15.18	11.25	74.11	23.78	151.23	3596.25
36M	16.18	13.09	80.90	22.28	185.23	4126.92
P. O. J. 213	14.18	10.98	77.46	21.82	151.59	3307.69
P. O. J. 234	16.68	14.02	84.03	23.54	202.41	4764.73
P. O. J. 2725	14.83	11.01	74.30	24.47	148.23	3627.18
C. P. 177	13.93	10.06	72.21	20.45	133.07	2721.28
C. P. 807	14.43	11.28	78.19	31.50	156.59	4932.58
Co 281	14.88	11.77	79.13	17.80	164.50	2928.10
C. P. 130	No mill test		......	16.20	....	....

In the Sterling plant cane series, C. P. 807 gave the highest field tonnage; outyielding P. O. J. 2725 by 7.03 tons per acre; P. O. J. 36 by 7.72 tons per acre; 36M by 9.22 tons per acre; P. O. J. 213 by 9.68 tons per acre, and P. O. J. 234 by 7.96 tons per acre. C. P. 807 gave the highest sugar per acre yield; giving 167.85 pounds more than P. O. J. 234; 1336.33 pounds more than P. O. J. 36; 805.66 more than 36M and 1624.89 pounds per acre more than P. O. J. 213. P. O. J. 234 gave the highest sugar per ton yield; giving 51.18 pounds per ton more than P. O. J. 36; 17.18 pounds per ton more than 36M; 50.82 pounds per ton more than P. O. J. 213; and 45.82 pounds per ton more than C. P. 807.

YOUNGSVILLE TEST FIELD

This test field is located in the parish of Lafayette, on Olivier silt loam soil. The work is in cooperation with Mr. F. M. Burley, Youngsville, La. During the season of 1929, the work was conducted on three fields: Second stubble; first stubble and plant cane. The second stubble was planted on Nov. 4, 1926; harvested Nov. 18-20, 1927, Nov. 7-9, 1928, and Oct. 18, 1929. The first stubble was planted Oct. 25, 1927; harvested Dec. 21-22, 1928, and Nov. 8, 1929. The plant cane was harvested Dec. 20-26, 1929, and planted Nov. 3, 1928. The plant cane field was harvested after the killing freezes of Nov. 30, Dec. 3, 4, 19, 20, 21, 22, 23 and 24, 1929; most of this cane going through the heavy sleet and ice of Dec. 21-24. On account of the frozen condition of the cane, it was topped back about four joints. During the heavy ices, the cane was coated with about ¼ inch of ice; this additional weight caused P. O. J. 213 and 234 to fall to the ground completely; while P. O. J. 36 and 36M were fairly erect. The average results of field and chemical data are given in the following tables: No. 12, second stubble; No. 13, first stubble; and No. 14, plant cane.

TABLE NO. 12

Youngsville Second Stubble

Variety	Normal Juice			Tons Per Acre	Lbs. 96° Sugar	
	Brix.	Sucrose	Purity		Per Ton	Per Acre
P. O. J. 36	14.30	10.07	70.45	24.05	130.90	3148.15
P. O. J. 213	13.25	8.98	67.75	20.33	113.61	2309.69
P. O. J. 228	13.70	9.39	68.50	19.10	119.72	2286.65
P. O. J. 234	16.50	12.46	75.50	......	Handmill	
P. O. J. 979	14.70	9.72	66.08	7.30	120.68	880.96

In the second stubble results, P. O. J. 36 is the outstanding variety; surpassing P. O. J. 213, second ranking variety, in field tonnage by 3.72 tons per acre, and yielding 17.29 pounds more of sugar per ton, and 838.46 pounds more of sugar per acre. No results were obtained of P. O. J. 234, other than the handmill analysis, on account of poor stands.

TABLE NO. 13

Youngsville First Stubble

Variety	Normal Juice			Tons Per Acre	Lbs. 96° Sugar	
	Brix.	Sucrose	Purity		Per Ton	Per Acre.
P. O. J. 36	15.70	10 85	69.14	37.65	139.26	5243.14
36M	16.00	11.88	74.00	37.80	159.54	6030.61
P. O. J. 213	15.05	10.36	71.20	43.30	135.70	5875.81
P. O. J. 228	15.00	10.06	67.04	33.85	126.35	4076.95
P. O. J. 234	18.11	15.11	83.47	27.43	217.43	5964.10
P. O. J. 979	16.50	11.95	72.40	34.40	158.24	5443.45
P. O. J. 2725	16.20	12.48	77.09	33.80	171.81	5807.18
Purple	No mill test		......	18.05	....	....

The Youngsville first stubble results indicate that P. O. J. 213 is the leading variety in field tonnage; this variety yielding 5.65 tons per acre more than P. O. J. 36; 5.50 tons per acre more than 36M; and 15.87 tons per acre more than P. O. J. 234. The sugar per acre results show that 36M is the leading variety; yielding 787.47 pounds sugar more than P. O. J. 36; 154.80 pounds sugar per acre more than P. O. J. 213; and 66.51 pounds sugar per acre more than P. O. J. 234. In pounds of sugar per ton, P. O. J. 234 is first; outyielding P. O. J. 2725 by 45.62 pounds per ton; P. O. J. 36 by 78.15 pounds per ton; 36M by 57.89 pounds per ton and P. O. J. 213 by 81.73 pounds per ton. P. O. J. 2725 made a very good showing in the Youngsville section, giving very good tonnage and sugar yields. P. O. J. 213 and 234 lodged to a considerable extent; while P. O. J. 36 and 36M were erect.

TABLE NO. 14

Youngsville Plant Cane

Variety	Normal Juice			Tons Per Acre	Lbs. 96° Sugar	
	Brix.	Sucrose	Purity		Per Ton	Per Acre
P. O. J. 36	12.40	9.61	77.48	27.07	132.69	3591.91
36M	13.90	10.34	74.43	28.22	139.37	3933.02
P. O. J. 213	13.80	11.53	83.58	27.85	166.06	4624.77
P. O. J. 234	14.30	11.04	77.18	25.95	152.08	3946.47
P. O. J. 2725	12.40	9.70	78.25	25.25	134.72	3401.68
Co 281	12.80	9.11	71.19	26.25	119.31	3131.88
C. P. 807	No mill test		......	35.10	....	....

In the Youngsville plant cane series, C. P. 807 gave the highest tonnage; there was not sufficient cane of this variety to properly conduct a mill test. However, comparative handmill analyses of this variety are presented elsewhere in this report. 36M is the second highest variety in tonnage; giving 1.15 tons per acre more than P. O. J. 36; .37 tons per acre more than P. O. J. 213; 2.27 tons per acre more than P. O. J. 234; 2.97 tons per acre more than P. O. J. 2725 and 1.97 tons per acre more than Co 281. P. O. J. 213 gave the highest sugar per acre yield; giving 1032.86 pounds sugar per acre more than P. O. J. 36; 691.75 pounds sugar per acre more than 36M; and 678.30 pounds sugar per acre more than P. O. J. 234. P. O. J. 213 gave the highest sugar per ton yield; giving 33.37 pounds per ton more than P. O. J. 36; 26.69 pounds per ton more than 36M and 13.98 pounds per ton more than P. O. J. 234.

TABLE NO. 15

THREE YEAR AVERAGES OF PLANT CANE RESULTS

Calculated in Pounds of Ninety-Six Test Sugar

Test Fields:		Cinclare		Glenwood		Reserve		Sterling		Youngsville	
Variety	Year	Per Ton	Per Acre	Per Ton	Per Acre	Per Ton	Per Acre	Per Ton	Per Acre	Per Ton	Per Acre
P. O. J. 36	1927	129.0	4353.7	149.4	3815.7	131.3	4729.2	183.3	4559.9	172.5	6720.6
P. O. J. 36	1928	152.5	4706.1	127.4	4203.3	111.0	3619.6	170.3	5107.8	130.7	4939.4
P. O. J. 36	1929	113.5	4364.4	132.1	4390.7	....	....	151.2	3596.3	132.7	3591.9
Averages ...	....	131.7	4474.7	136.3	4136.5	121.1	4174.4	168.2	4421.3	145.3	5083.9
P. O. J. 213	1927	154.0	6097.4	170.7	4226.5	155.9	5857.2	202.2	3837.0	160.5	5501.9
P. O. J. 213	1928	171.1	6055.5	115.6	4416.3	134.9	4757.3	197.4	5799.6	118.0	4878.1
P. O. J. 213	1929	112.5	4757.1	134.6	5050.6	....	....	151.6	3307.7	166.1	4624.8
Averages	....	145.9	5636.6	140.3	4564.4	145.4	5307.2	183.7	4314.8	148.2	5001.6
P. O. J. 234	1927	158.0	4266.0	181.5	3706.2	148.0	4576.8	209.1	4261.7	193.9	6656.6
P. O. J. 234	1928	185.7	4646.5	131.9	3470.8	142.9	3833.7	222.1	5536.2	157.8	4809.4
P. O. J. 234	1929	158.2	5071.2	164.7	4763.1	....	....	202.4	4764.7	152.1	3946.5
Averages	....	167.3	4661.2	159.4	3980.0	145.5	4205.2	211.2	4854.2	167.9	5137.5

1928 AND 1929 PLANT CANE AVERAGES

Variety	Year	Cinclare Per Ton	Cinclare Per Acre	Glenwood Per Ton	Glenwood Per Acre	Reserve Per Ton	Reserve Per Acre	Sterling Per Ton	Sterling Per Acre	Youngsville Per Ton	Youngsville Per Acre
P. O. J. 36	....	133.0	4535.2	129.8	4297.0	....	....	160.8	4352.0	131.7	4265.7
36M	....	151.1	4827.7	149.5	5015.8	....	....	186.3	4417.4	145.5	4595.5
P. O. J. 213	....	141.8	5406.3	125.1	4733.4	....	....	174.5	4553.7	142.0	4752.5
P. O. J. 234	....	171.9	4858.9	148.3	4058.5	....	....	212.2	5150.5	154.9	4377.9

Foot Note: Reserve Test Field results given for two years, 1927 and 1928.

TABLE NO. 16

Two Years' Results and Averages of First Stubble

Calculated in Pounds of Ninety-Six Test Sugar

Test Fields:		Cinclare		Glenwood		Reserve		Sterling		Youngsville	
Variety	Year	Per Ton	Per Acre	Per Ton	Per Acre	Per Ton	Per Acre	Per Ton	Per Acre	Per Ton	Per Acre
P. O. J. 36	1928	143.2	2403.1	147.0	2804.8	145.9	3601.6	174.5	3595.1	142.7	4930.7
P. O. J. 36	1929	182.4	6101.8	171.6	5729.8	134.9	5100.7	211.6	4956.6	139.2	5243.1
Averages	....	162.8	4252.4	159.3	4267.3	140.4	4351.1	193.0	4275.8	140.9	5086.9
P. O. J. 213	1928	159.8	3483.0	167.8	3792.0	145 5	4196.8	180.8	3724.9	130.2	5095.4
P. O. J. 213	1929	170.8	6150.2	174.8	6584.3	141.6	5563.3	214.2	5268.1	135.7	5875.8
Averages	....	165.3	4816.6	171.3	5188.1	143.6	4880.0	197.5	4496.5	132.9	5485.6
P. O. J. 234	1928	181.9	2832.5	182.3	2374.7	151.7	3241.0	172.2	2788 8	157.7	3699.9
P. O. J. 234	1929	148.8	3897.2	188.4	5519.8	144.8	4299.7	225.0	4728.6	217.4	5964.1
Averages	....	165.4	3364.8	185.4	3947.2	148.3	3770.3	198.6	3758.7	187.5	4832.0

HANDMILL ANALYSES OF TEST FIELD SUGARCANE VARIETIES

Cinclare Test Field

Variety	Date	Brix	Sucrose	Purity
First Stubble:				
P.O.J. 36	10/ 4/29	13.30	9.41	70.70
	10/26/29	16.43	13.37	81.38
36M	10/ 4/29	13.80	9.93	71.90
	10/26/29	15.93	12.68	80.73
P.O.J. 213	10/ 4/29	14.10	10.44	70.40
	10/26/29	15.73	13.23	84.11
P.O.J. 234	10/ 4/29	13.60	9.15	67.20
	10/26/29	17.23	14.90	86.47
P.O.J. 2725	10/ 4/29	11.70	6.59	56.30
Plant Cane:				
P.O.J. 36	10/ 4/29	11.60	7.05	60.70
	10/26/29	13.53	9.27	68.51
36M	10/ 4/29	12.20	8.40	68.80
	10/26/29	14.63	10.82	73.96
P.O.J. 213	10/ 4/29	12.40	7.67	61.80
	10/26/29	12.13	9.30	75.61
P.O.J. 234	10/ 4/29	14.20	11.03	77.70
	10/26/29	17.53	14.90	85.00
P.O.J. 2725	10/ 4/29	12.10	7.59	62.70
C.P. 130	10/ 4/29	13.40	9.22	68.80
	10/26/29	15.20	11.81	77.70
	11/20/29	15.71	12.22	77.78
C.P. 177	10/ 4/29	10.90	6.37	58.40
	10/26/29	12.93	8.43	65.20
	11/20/29	11.84	7.02	59.29
C.P. 807	10/ 4/29	11.30	7.15	63.30
	10/26/29	13.83	10.82	78.24
	11/20/29	16.27	13.30	81.75
	12/31/29	16.77	9.18	*54.74
CO 281	10/ 4/29	12.60	8.55	67.80
	10/26/29	14.40	10.84	75.28
	11/20/29	15.04	11.17	74.26
	12/31/29	16.71	12.69	†75.94

*Windrowed November 22.

†Windrowed November 22.

MEEKER TEST FIELD

Plant Cane

Variety	Date	Brix	Sucrose	Purity
P.O.J. 36	10/ 1/29	10.90	6.06	55.50
	10/15/29	11.60	6.29	54.22
	11/ 7/29	12.80	8.00	62.50
	11/17/29	14.10	9.69	68.37
36M	10/ 1/29	11.30	6.42	56.80
	10/15/29	14.00	9.41	67.20
	11/ 7/29	14.20	9.56	67.32
	11/15/29	13.00	8.23	62.25
P.O.J. 213	10/ 1/29	11.40	6.92	60.70
	10/15/29	11.10	5.97	53.80
	11/ 7/29	11.70	6.50	55.50
	11/15/29	14.10	10.15	71.99
P. O. J. 234	10/ 1/29	11.70	6.44	55.00
	10/15/29	12.95	7.88	60.85
	11/ 7/29	11.30	5.50	48.67
	11/15/29	13.15	8.55	65.02
P.O.J. 2725	10/ 1/29	10.70	5.58	52.10
	10/15/29	11.65	6.32	54.25
	11/ 7/29	11.50	6.77	58.90
	11/15/29	14.70	10.43	70.95
C.P. 130	10/ 1/29	12.00	7.10	59.10
	10/15/29	12.90	7.88	78.79
	11/ 7/29	14.20	9.56	67.32
	11/15/29	13.95	10.75	77.06
C.P. 177	10/ 1/29	10.00	4.68	46.80
	10/15/29	11.55	6.44	55.76
	11/ 7/29	12.40	7.49	60.40
	11/15/29	12.70	7.71	60.71
C.P. 807	10/ 1/29	11.00	5.88	53.40
	10/15/29	11.70	6.60	56.40
	11/ 7/29	14.35	10.45	72.75
	11/15/29	14.60	10.68	73.15
Co 281	10/ 1/29	10.20	5.11	50.10
	10/15/29	12.36	7.57	61.83
	11/ 7/29	15.60	10.75	68.92
	11/15/29	16.30	13.00	70.95

GLENWOOD TEST FIELD

Variety	Date	Brix	Sucrose	Purity
First Stubble:				
P.O.J. 36	10/ 7/29	14.59	11.34	77.70
	11/ 1/29	15.87	13.37	84.24
36M	10/ 7/29	15.89	13.06	82.20
	11/ 1/29	17.37	15.79	90.90
P.O.J. 213	10/ 7/29	14.99	12.42	82.80
	11/ 1/29	16.47	14.39	83.37
P.O.J. 234	10/ 7/29	15.39	12.28	79.90
	11/ 1/29	18.17	16.57	91.19
P.O.J. 2725	10/ 7/29	12.19	7.90	64.90
Plant Cane:				
P.O.J. 36	10/ 7/29	12.37	8.37	67.70
	10/22/29	14.11	10.84	76.82
	12/ 3/29	15.37	11.94	77.68
36M	10/ 7/29	11.94	7.59	63.60
	10/22/29	13.57	9.53	70.22
	12/ 3/29	15.90	12.93	*81.32
P.O.J. 213	10/ 7/29	11.37	6.49	57.00
	10/22/29	14.13	11.02	77.99
	12/ 3/29	13.73	10.17	74.07
P.O.J. 234	10/ 7/29	13.89	10.07	72.50
	10/22/29	16.37	13.26	81.00
	12/ 3/29	16.48	14.71	89.26
C.P. 130	10/ 7/29	13.79	9.79	70.90
	10/22/29	15.70	12.39	78.56
	12/ 3/29	15.55	12.73	81.86
C.P. 177	10/ 7/29	13.29	9.57	72.00
	10/22/29	16.11	13.70	85.04
	12/ 3/29	16.48	14.02	85.07
C.P. 807	10/ 7/29	11.77	8.41	71.50
	10/22/29	13.23	9.99	75.51
	12/ 3/29	16.01	11.27	†70.39
Co 281	10/ 7/29	12.77	8.87	69.40
	10/22/29	14.80	11.70	79.05
	12/ 3/29	16.12	13.40	83.68

*Windrowed November 24.

†Windrowed November 24.

RESERVE TEST FIELD

Variety	Date	Brix	Sucrose	Purity
Second Stubble:				
P.O.J. 36	10/ 9/29	12.30	7.75	63.00
	10/23/29	15.60	11.92	76.50
P.O.J. 213	10/ 9/29	11.80	7.46	63.20
	10/23/29	15.70	12.84	81.80
P.O.J. 234	10/ 9/29	14.10	9.70	68.80
	10/23/29	14.20	10.76	75.80
P.O.J. 228	10/23/29	13.90	9.84	70.80
P.O.J. 826	10/23/29	16.30	12.71	78.00
P.O.J. 979	10/23/29	16.60	12.54	73.60
P.O.J. 2379	10/23/29	13.50	9.61	71.20
First Stubble:				
P.O.J. 36	10/ 9/29	13.50	9.27	68.70
	10/23/29	14.10	9.75	69.20
	12/ 4/29	15.50	12.04	77.70
36M	10/ 9/29	14.50	10.47	72.20
	10/23/29	16.00	12.64	79.00
	12/ 4/29	17.50	15.02	*85.80
P.O.J. 213	10/ 9/29	12.20	8.20	67.20
	10/23/29	14.00	10.24	73.20
	12/ 4/29	15.70	12.76	† 81.20
P.O.J. 234	10/ 9/29	14.30	10.80	76.00
	10/23/29	16.30	13.23	81.20
	12/ 4/29	17.30	15.19	‡87.80
P.O.J. 2725	10/ 9/29	13.40	8.59	64.10
Plant Cane:				
P.O.J. 36	10/ 9/29	13.30	9.44	71.00
	10/22/29	15.10	11.65	77.20
	12/ 4/29	15 50	12.04	**77.70
36M	10/ 9/29	12.60	8.29	65.80
	10/23/29	16.30	13.04	80.00
	12/ 4/29	16.20	13.12	81.00
P.O.J. 213	10/ 9/29	12.10	7.96	65.80
	10/23/29	14.90	11.74	78.80
	12/ 4/29	15.80	13.27	††84.00
P.O.J. 234	10/ 9/29	14.50	10.73	74.00
	10/23/29	16.50	13.44	81.50
	12/ 4/29	16.90	14.16	‡‡83.80

*1.4% acidity.
†2 1% acidity.
‡1.6% acidity.

**1.6% acidity.
††1.5% acidity.
‡‡1.8% acidity.

RESERVE TEST FIELD—Continued

Variety	Date	Brix	Sucrose	Purity
P. O. J. 2725	10/ 9/29	13.30	9.02	67.80
C. P. 130	10/ 9/29	13.80	9.80	71.00
	10/23/29	14.10	11.04	78.30
	12/ 4/29	14.70	10.90	*74.20
C. P. 177	10/ 9/29	13.10	8.21	67.20
	10/23/29	15.40	10.82	70.30
	12/ 4/29	14.50	11.35	**78.30
C P. 807	10/ 9/29	13.80	9.96	72.20
	10/23/29	14.20	11.11	78.30
	12/ 4/29	15.90	13.19	†83.00
Co 281	10/ 9/29	15.20	11.31	74.40
	10/23/29	15.70	12.34	78.60
	12/ 4/29	17.00	14.19	‡83.50

*2.0% acidity.
**2.2% acidity.
†1.9% acidity.
‡1.4% acidity.

STERLING TEST FIELD

Variety	Date	Brix	Sucrose	Purity
Second Stubble:				
P. O. J. 36	10/ 9/29	16.80	14.59	83.63
P. O. J. 213	10/ 9/29	16.45	13.16	80.00
P. O. J. 234	10/ 9/29	16.74	13.42	80.16
First Stubble:				
P. O. J. 36	10/ 9/29	17.10	14.59	85.32
36M	10/ 9/29	18.25	15.95	87.39
P. O. J. 213	10/ 9/29	16.25	13.32	81.97
P. O. J. 234	10/ 9/29	18.15	15.80	86.98
P. O. J. 2725	10/ 9/29	15.20	11.18	73.55
Plant Cane:				
P. O. J. 36	10/ 9/29	14.95	11.22	75.05
	10/21/29	15.50	11.93	76.96
	11/12/29	17.05	14.44	84.69
36M	10/ 9/29	14.65	10.25	70.00
	10/21/29	16.10	12.81	79.56
	11/12/29	17.80	15.41	86.57
P. O. J. 213	10/ 9/29	13.25	9.08	68.53
	10/21/29	15.30	11.61	75.88
	11/12/29	16.25	13.24	81.47
P. O. J. 234	10/ 9/29	16.55	13.11	79.21
	10/21/29	17.50	14.58	83.31
	11/12/29	19.00	16.46	86.83
P. O. J. 2725	10/ 9/29	12.65	7.97	63.00
C. P. 130	10/ 9/29	15.15	11.22	74.05
	10/21/29	16.90	13.83	81.83
	11/12/29	16.25	13.59	77.47
C. P. 177	10/ 9/29	15.10	11.24	74.43
	10/21/29	15.30	11.49	75.09
	11/12/29	17.25	13.98	81.04
C. P. 807	10/ 9/29	13.35	9.90	74.16
	10/21/29	14.20	10.95	77.11
	11/12/29	15.90	13.01	81.82
Co 281	10/ 9/29	13.50	9.20	68.15
	10/21/29	15.30	11.53	75.35
	11/12/29	17.15	14.88	86.88

YOUNGSVILLE TEST FIELD

Variety	Date	Brix	Sucrose	Purity
Second Stubble:				
P. O. J. 36	10/11/29	13.60	9.18	67.50
	10/17/29	16.60	12.68	76.40
P. O. J. 213	10/11/29	14.90	11.19	75.10
	10/17/29	15.40	10.78	70.00
P. O. J. 234	10/11/29	16.40	12.99	79.20
	10/17/29	16.50	12.46	75.50
First Stubble:				
P. O. J. 36	10/11/29	15.50	11.90	76.80
36M	10/11/29	16.30	12.65	77.60
P. O. J. 213	10/11/29	16.70	13.51	80.90
P. O. J. 234	10/11/29	17.70	14.62	82.60
P. O. J. 2725	10/11/29	14.50	10.32	71.20
Plant Cane:				
P. O. J. 36	10/11/29	13.40	9.25	69.00
	10/28/29	15.10	11.31	74.91
	11/18/29	15.40	11.80	76.68
36M	10/11/29	14.20	10.04	70.70
	10/28/29	16.50	11.48	75.67
	11/18/29	16.75	13.66	81.57
P. O. J. 213	10/11/29	12.70	8.18	64.40
	10/28/29	14.30	9.99	69.87
	11/18/29	15.70	12.99	82.78
P. O. J. 234	10/11/29	16.50	13.08	79.30
	10/28/29	16.20	12.54	77.45
	11/18/29	18.00	15.32	85.13
P. O. J. 2725	10/11/29	13.90	9.60	69.10
C. P. 130	10/11/29	16.00	12.66	79.10
	10/28/29	15.40	11.58	75.25
	11/18/29	16.40	13.20	80.50
C. P. 177	10/11/29	14.30	10.54	73.70
	10/28/29	17.30	13.36	77.27
	11/18/29	17.15	14.09	82.16
C. P. 807	10/11/29	14.10	10.25	72.70
	10/28/29	15.00	11.46	76.40
	11/18/29	16.05	13.29	82.85
Co 281	10/11/29	12.80	8.58	67.00
	10/28/29	15.30	11.27	73.69
	11/18/29	15.85	12.62	79.62

SUMMARY.

The results of the field and mill performance of the sugarcane varieties at the Experiment Station test fields, as plant cane, first stubble and second stubble are presented in the preceding tables. In addition a short resume is given, describing the performance of the leading varieties at each test field during the past season.

The experiments on second stubble in 1929, were conducted at Reserve, Franklin and Youngsville. At Reserve, in the alluvial soil section, P. O. J. 213 produced the highest tonnage; closely followed by P. O. J. 36; while P. O. J. 234 was a poor third, yielding 15.71 tons per acre less than P. O. J. 213. However, P. O. J. 234 lead in pounds of sugar per ton, yielding 11.41 pounds more than P. O. J. 36, and 26.93 pounds more than P. O. J. 213. At Franklin in the Teche country, P. O. J. 36 was the leading variety, closely followed by P. O. J. 213 in field results; while P. O. J. 234 was 10.85 tons per acre under P. O. J. 36. In the handmill analyses, P. O. J. 234 indicated the highest sugar per ton yield; while P. O. J. 36 and 213 were practically the same. The second stubble results at Youngsville, located in the western section where the soils are lighter and better drained, show that P. O. J. 36 surpassed both P. O. J. 213 and 234 in field tonnages; giving 3.72 tons per acre more than P. O. J. 213. In sugar per ton yield, P. O. J. 234 was first, followed by P. O. J. 36 and 213. In sugar per acre yield, P. O. J. 36 gave 838.46 pounds sugar more than P. O. J. 213.

In the 1929 first stubble results, sugar per ton yields, P. O. J. 36 was first at Cinclare; 36M first at Glenwood and Reserve, and P. O. J. 234 first at Sterling and Youngsville. P. O. J. 213 gave the highest sugar per acre yield at Cinclare, Glenwood, Reserve and Sterling; while at Youngsville 36M was the leading variety. In the general average of sugar per acre yields, P. O. J. 213 is first, 36M second, P. O. J. 36 third and P. O. J. 234 fourth.

The average sugar per ton and sugar per acre results of the released plant cane varieties for 1929, indicate that P. O. J. 234 is first, 36M second, P. O. J. 213 third and P. O. J. 36 fourth.

In the new plant cane varieties, C. P. 807 and Co 281 are the most promising, having made a very commendable showing in comparison with the four field varieties. C. P. 807 performed exceedingly well in all of the different sections of the cane belt; while Co 281 responded better in the alluvial soils. This would seem to indicate that the latter variety is better adapted for the richer alluvial soil types, than it is for the soil types of the Teche and western country. P. O. J. 2725 is another variety that made a fine showing this past season as plant cane. In the average results, it outranked P. O. J. 36 and 213, from the standpoints of field tonnage and sugar per acre yields. However, it still shows that tendency of late maturity, both as plant and stubble.

In the plant cane sugar per ton averages, the varieties are in the following order: (1) P. O. J. 234; (2) Co 281; (3) 36M; (4) C. P. 807; (5) C. P. 177; (6) P. O. J. 2725; (7) P. O. J. 36 and (8) P. O. J. 213. In sugar per acre yields the classification is as follows: (1) C. P. 807; (2) P. O. J. 2725; (3) P. O. J. 234; (4) Co 281; (5) 36M; (6) C. P. 177; (7) P. O. J. 213 and (8) P. O. J. 36.

The two years' plant cane averages for 1928 and 1929, indicate that P. O. J. 213 is the leading variety at Cinclare and Youngsville; while 36M was highest at Glenwood and P. O. J. 234 highest at Sterling. In every case 36M exceeded P. O. J. 36 in sugar per ton and sugar per acre yields. P. O. J. 234 gave the highest sugar per ton yields at all places except Glenwood.

The three years' plant cane averages show that P. O. J. 234 is the leading variety from the standpoint of yield of sugar per ton. In the sugar per **acre** averages of the three alluvial section test fields, P. O. J. 213 is the outstanding cane; with P. O. J. 234 second ranking variety at Cinclare and Reserve, and P. O. J. 36 second at Glenwood. In the Teche and western country, P. O. J. 234 is the outstanding plant cane variety; with P. O. J. 36 second, and P. O. J. 213 third. At both places, however, P. O. J. 213 gave higher sugar per ton yields than P. O. J. 36.

The results of the past season indicate very plainly that 36M has outclassed P. O. J. 36 in sugar per ton and sugar per acre yields. While P. O. J. 213 has given heavier field yields, 36M has in most cases given better sugar per ton results. It would seem, therefore, that 36M should have a more important place in the general field program than P. O. J. 36, and also a slightly better place than P. O. J. 213. The P. O. J. 234 variety, which performed in such an excellent manner, both as plant cane and first stubble this past season, has its place on the plantation.

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16

Factors Influencing the Severity of the Root Rot Troubles of Sugar Cane

Buls 177-212 ✓

BY

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FACTORS INFLUENCING THE SEVERITY OF THE ROOT ROT TROUBLES OF SUGAR CANE

H. H. FLOR[1]

INTRODUCTION

IN THE HISTORY of the sugar cane industry, the intermittent replacement of old varieties with new ones forms one of the important chapters in most sugar producing countries. In most regions, the industry was started with some of the noble canes, such as Bourbon, Otaheite, or Lahaina, but after a time, on account of declining yields, these were abandoned. While the failure of these canes has usually been more or less gradual, sudden crop failures followed by financial crises have occurred in some countries. Such a crisis occurred in the islands of Mauritius and Bourbon as early as 1846. Another occurred in the Mayaguez district of Porto Rico in 1872. Jamaica and other islands in the British West Indies have also had similar crises. In Cuba, the Cana Blanca (Otaheite) variety has been almost completely abandoned, but the change to other varieties has been gradual on account of the large areas of virgin lands suitable for cane culture. In Hawaii, the Lahaina has been almost completely replaced by H 109 and other varieties, while in Java there have been several changes of varieties.

During recent years, the sugar industry of Louisiana has passed through a crisis in many ways similar to those which had occurred in the tropics. Beginning about 1908 or 1909 there was a gradual decline in the yield of sugar per acre until about 1923. Previous to 1909, the acre yield of sugar in Louisiana had been about 3,000 pounds, but this decreased to about 2,000 pounds during the following fifteen years. After 1923, due to the presence of the mosaic and other diseases and the occurrence of several seasons with adverse growing conditions, the average sugar yield again took a sharp decline. From 1923 to 1926, the cane crops of the state were practically failures. The D 74 and the so-called native varieties, Louisiana Purple and Striped canes, were unable to make satisfactory yields under the conditions existing on the plantations. Sugar production reached its lowest point in 1926 when 68,000 tons of sugar were produced, as compared with a 10-year average (1911-1920) of 230,000 tons. During this period of depression, certain Java seedlings capable of growing well under Louisiana conditions were introduced and propagated. By the fall of 1929, most of the acreage was planted with these canes.

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[1] The writer gratefuly acknowledges his indebtedness to Dr. C. W. Edgerton, who suggested the problem, for encouragement and helpful criticism during the investigation, and for assistance in the preparation of this manuscript.

Many theories have been advanced from time to time to explain the declining yields of sugar cane varieties. The problem is extremely complex and undoubtedly in the final solution many different factors must be considered. One of the factors which has played an important role in decreasing cane yields in many countries is the disease or group of diseases commonly called root rot, root disease, root rot complex, and growth failure complex. In this bulletin, only this phase of the problem is considered. The root rot problem includes the following: (a) The possibility of a physiological deterioration of the cane itself; (b) the influence of nutritional and physical soil condition on cane growth; (c) the rotting of the roots by fungous parasites and (d) the effect of nematodes and other soil animals that attack the root system of the cane plant.

HISTORICAL

In regard to the theory that reduction in yield may be due to senility or a physiological deterioration of a variety, it has been proved quite conclusively by Lyon (30) in Hawaii that the failure to grow does not rest in the cane itself. By transferring severely affected stools from Waipio, where the root rot trouble was severe, to Honolulu, where it did not occur, he demonstrated that the Lahaina variety had not lost its ability to grow and produce large and vigorous canes. He stated that "by the end of the summer, these stools had produced a perfect stand of as healthy Lahaina cane as could be found anyhere in the Islands."

The importance of physical and nutritional soil factors and their relation to the growth failure problem has been studied by a number of investigators. Sorauer (38) stated that the experiments of Kammerling confirmed beyond all doubt that the root rot of sugar cane was a constitutional disease caused by a compacting of the soil. As the disease was most severe in heavy clay soils, the addition of humus was recommended as a corrective. McGeorge (32) recognized the similarity between the root rot or Lahaina disease of cane in Hawaii and a root rot of corn in the United States which had been described by Hoffer (22). He found that salts of aluminum in the concentrations present in many acid soils had a toxic action upon the growth of sugar cane. Varieties differed in their susceptibility to aluminum toxicity. Potash in large quantities and phosphate were correctives, whereas, lime gave little or no immediate response. Bird (3) reported that the epidemics of dying cane, which have been periodic in Demerara, have been attributed to various root diseases, but in all probability their prime cause has been the toxic effect of excessive magnesia.

The role played by fungi has been the dominant phase in most investigations on the growth failure problem. Earle (11) reports that Treub (41), in 1885, referred at some length to a Pythium as a possible cause of sugar cane root rot in Java. Wakker (44, 45), however, also working in Java, seems to have been the first to assign a definite cause for the disease. Although he mentioned the occurrence of Pythium, he concluded that a species of Marasmius was the principal cause. Wakker's work seemed to have influenced that of other investigators as root rot was later ascribed to *Marasmius sacchari* by workers in Barbados

(24, 29), Cuba (23), Hawaii (8), and Porto Rico (26). Other organisms that have been held responsible, at least in part, for root rot are: *Marasmius plicatus* in Louisiana (12, 18); *Ithylallus corallodies* in Hawaii (8); Rhizoctonia species in Porto Rico (33), Barbados (4), and Louisiana (14, 15, 40); and Pythium in Porto Rico (33), Hawaii (5, 6, 7), and Louisiana (14, 15, 16, 40). The investigators in Louisiana found that *Marasmius plicatus* was often present on plants affected with root disease but extensive inoculation experiments in the field of greenhouse did not show that it was capable of injuring cane seriously. They also found that certain strains of Rhizoctonia are capable of rotting cane roots in sterilized soil, but decreased yields were not obtained consistently in field inoculations. They also isolated a number of strains of Pythium from cane roots, some of which were found to be actively parasitic on cane roots, others mildly parasitic, while a few were practically non-parasitic. The Pythium strains which were parasitic on cane were also able to attack other members of the grass family including corn, wheat, oats, sorghum, and rice. Recently, Drechsler (10) has described a Pythium from corn roots as a new species, *Pythium arrhenomanes*, and Johann *et al* (25) have shown that this Pythium is responsible for a serious corn root rot, especially in wet soils at low temperatures. The identity of *Pythium arrhenomanes* with strains found on sugar cane roots was not established.

Nematodes and other soil inhabiting animals have also been studied in connection with the root rot problem. In 1889, Kruger (27) reported a gall forming nematode, *Heterodera radicicola* (Muller), and a non-gall forming one, *Tylenchus sacchari* (Saltwedel), on the roots of sugar cane in Java. In 1908, Cobb (8) reported the root knot nematode and *Tylenchus biformis* (Cobb), later found to be *Tylenchus similis* (Cobb) (9), in the roots of sugar cane in Hawaii. Matz (34) reported a gall forming nematode injuring cane in loose sandy soils in Porto Rico. Muir and Henderson (35) reported the infection of sugar cane roots in Hawaii by *Heterodera schachtii* (Schmidt) in addition to the two species reported by Cobb.

The pitting and eating of sugar cane roots by soil animals has been commonly observed in most fields where sugar cane is grown. Rands (36), in 1924, brought out the possible relation of root pitting to the root rot situation in Louisiana. He attributed this pitting of sugar cane roots to a small snail, *Zonitoides arboreus* (Say), and thought that the pits made possible the entrance of root rotting fungi. Later (37), he found two centipedes contributing to the damage formerly attributed to snails. Van Zwaluwenburg (43) found a Collembolous insect (Isotomodes) and two species of centipedes primarily concerned with root pitting in Hawaii. Barnum and Van Zweluwenburg (2) found that the growth of cane was reduced by either Isotomodes or Pythium, but that the loss was more pronounced when both were present. The Isotomodes which feed on young tissues caused a great reduction in the number of secondary and tertiary roots. Spencer and Stracener (39) in controlled experiments were unable to verify Rands' observations that snails played the most important role in the pitting of cane roots in Louisiana. These investigators found pitting was due primarily to the feeding activities of Collembolous insects and, to a less extent, Symphylids. The destruction of secondary and tertiary rootlets seemed to be more important than pitting. Edgerton and Tims (15) found that pitting occurred very extensively throughout the sugarcane area of Louisiana. They made a detailed examination of a large number of pitted cane roots and found that a great majority of the pits extended only to the central stele, and that less than five percent penetrated the pericycle.

SYMPTOMS OF ROOT ROT

The terms root rot and root disease have been used in various sugar cane producing countries to refer to any failure of the plants to grow as they should on account of the failure of the roots to function normally. As many factors influence the growth of the plants and the normal functioning of the roots, the terms, *growth failure complex,* as used in Hawaii, and *root rot complex,* as used in Louisiana, are more descriptive.

The characteristics of plants affected with root rot vary to a certain extent. The most evident symptom is the failure of the plants to grow normally. Throughout the spring and early summer, the affected plants have a stunted appearance, fail to stool normally, and are of a light green or yellow color. In advanced stages, the tips and margins of the leaves often turn brown and die. The roots are shortened, greatly reduced in numbers and rotted. In severe cases, the root system is so deficient that the whole stool may be pulled from the ground with little effort.

STATEMENT OF THE PROBLEM

From the nature of the symptoms it is evident that anything which affects the development or functioning of the roots becomes a factor in the root rot problem of sugar cane. As many factors may affect the root system of cane plants, it can be seen that the active factors in one country may not be the same as in another.

At the Louisiana Agricultural Experiment Station, there has been in progress for a number of years an extensive study of the root rot problem. Articles (15, 16, 40) already published have shown the relation of certain parasitic fungi, especially species of Pythium, to the problem and have brought out the importance of other factors.

In the present paper, certain phases of the root rot problem will be treated. These will include:

1. Studies on possible root rot causes other than the attack of parasitic fungi. These include the deterioration of the cane, accumulation of toxic substances in the soil, and the action of nematodes and other soil animals.
2. Studies of environmental conditions, such as temperature, moisture, and hydrogen-ion concentrations, which influence the activities of various parasitic organisms, including the fungous parasites.
3. Studies on the physiology of infection by Pythium.

DETERIORATION OF CANE

To test out the possibility of a physiological deterioration of cane and to determine whether plants suffering from root rot have lost their vitality or ability to grow, some tests were conducted in the fall of 1928. Healthy and severely diseased stalks of Louisiana Purple cane were obtained and separated into below ground (rhizomes) and above ground (tops) portions. These were planted in 10-quart pails filled with soil which had been taken from the field beneath diseased stools. In part of the pails, the soil was left untreated, and in the rest it was steamed for two hours at 15 pounds pressure. The soil was kept at a moisture content of 60 percent of its water-holding capacity. Three eyes were planted in each pail and two pails of healthy cane and five of diseased cane were used. Growth through the winter months was slow. The results of the measurements made in March, five months after planting, are given in table 1.

TABLE 1.

GROWTH OF DISEASED AND HEALTHY LOUISIANA PURPLE CANE IN STEAMED AND UNTREATED CANE-SICK SOIL.

Cane planted	Steamed Soil			Untreated Soil		
	Number of eyes	Average % germination	Av'age height of plants in inches	Number of eyes	Average % germination	Av'age height of plants in inches
Healthy rhizomes	6	50	44.5	6	50	33.0
Diseased rhizomes	15	80	40.2	15	27	25.0
Healthy tops	6	83	38.0	6	83	24.0
Diseased tops	15	80	39.2	15	87	21.6

The results which are similar to those obtained by previous investigators indicate that there is no physiological deterioration of the cane itself. The top buds from diseased and healthy stalks produced plants which grew equally well, though both made a decidedly better growth in the steamed soil. (Fig. 1). Plants developing from the

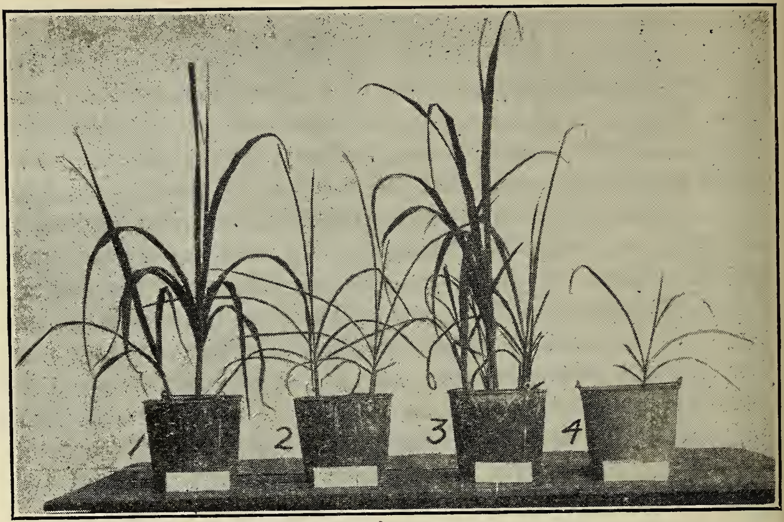

Fig. 1. Comparison of Louisiana Purple cane growing from top seed pieces taken from healthy and root rot affected stalks. Pail 1—Seed from healthy plant, in steamed soil. Pail 2—Seed from a healthy plant, in untreated soil. Pail 3—Seed from a plant severely affected with root rot, in steamed soil. Pail 4—Seed from a plant severely affected with root rot, in untreated soil.

rhizome buds of diseased stalks grew nearly as well as those from healthy stalks in the steamed soil, but in the untreated soil, the growth was poor, and many plants died (Fig. 2). This is in agreement with the field observations that poor stands often occur in the stubble crop, due to the fact that many cane stools suffering from root rot die during the winter.

Accumulation of Toxins in the Soil

With the rainfall of 55-60 inches, which normally occurs in the Louisiana cane belt, there is little chance under good drainage conditions for an accumulation of soluble toxic compounds in the soil. However, when the rivers are in flood stage, seepage spots often develop in the cane fields. Water is forced through underground channels to the seepage areas, where it rises to the surface. Here the soil surface is continually wet. If the water carries any

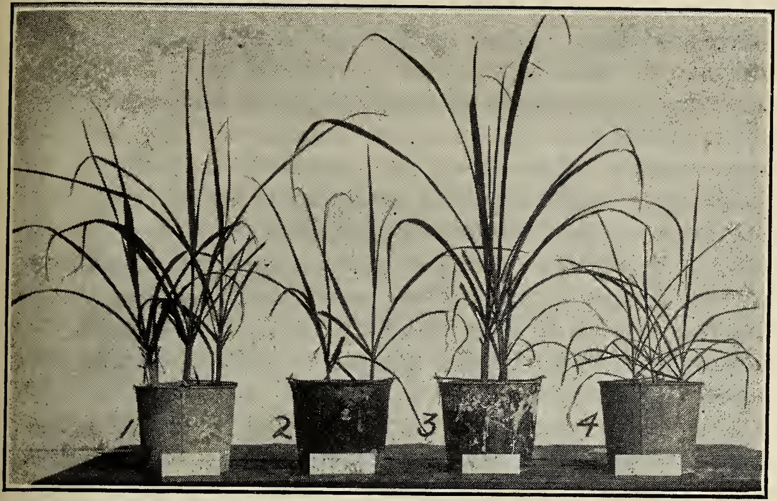

FIG. 2. Comparison of Louisiana Purple cane growing from rhizomes taken from healthy and root rot affected stalks. Pail 1—Rhizome from healthy plant, in steamed soil. Pail 2—Rhizome from healthy plant, in untreated soil. Pail 3—Rhizome from a plant severely affected with root rot, in steamed soil. Pail 4—Rhizome from a plant severely affected with root rot, in untreated soil.

appreciable quantity of salts or if toxic substances are produced in the soil, these could accumulate in the surface layer because of continual evaporation. Cane growing in seepage areas usually shows severe symptoms of root rot.

Inorganic salts which might accumulate in the surface layer of the soil would include, among others, sulphates of various metals. As certain of these sulphates are known to be toxic in certain soils, a greenhouse experiment was conducted to determine if similar results could be obtained with Louisiana cane soils. The sulphate salts of iron, aluminum, calcium and magnesium were added to a cane soil in six-inch pots in amounts varying from 0.5 to 20 times the molecular weight per million parts of soil. In this treated soil, D 74 cane was planted and allowed to grow for four months during the winter season.

The results obtained indicated that none of the salts was toxic in the proportions used. In Hawaii, McGeorge (32) had reported that culture solutions containing aluminum sulphate were toxic to root growth of cane. As 60 times the amount used in the Hawaiian experiment was added to the Louisiana soil, it is quite probable that aluminum toxicity is not an important factor in Louisiana. This soil was slightly alkaline (pH 7.8) in reaction and this factor alone precludes the chance of aluminum toxicity.

Another experiment was conducted in the fall of 1927 to determine if there were any soluble toxin present in the soil. Soil obtained from a seepage spot on which cane showed severe symptoms of root rot was taken to the greenhouse and divided into three lots. The first lot was thoroughly washed by filling pails with half soil and half water. The soil and water were stirred thoroughly and after settling over night, the water was poured off. This process was repeated six times. The soil was then air dried until of good tilth. The second lot was treated with live steam for two hours, and the third lot left untreated. The water-holding capacity of the untreated soil was obtained, using the method devised by Hilgard (21). After a thorough mixing, the soil was put in galvanized pails, each pail receiving the equivalent of 18 pounds of oven dried soil. The pails were divided into four series and enough water added to bring the moisture content to 25, 50, 75, and 100% of the moisture-holding capacity. Three single eye pieces of Louisiana Purple cane were planted per pail and four replications of each treatment were made. The results obtained are given in Table 2.

TABLE 2.

GROWTH OF LOUISIANA PURPLE CANE IN WASHED AND STEAMED SOIL. GREENHOUSE JANUARY 24 TO APRIL 10, 1928.

Percent of the water-holding capacity of the soil	Washed Soil		Untreated Soil		Steamed Soil	
	% germ.	Average height in in.	% germ.	Average height in in.	% germ.	Average height in in.
25%	67	12.1	25	5.7	17	12.0
50%	92	19.7	83	23.9	75	34.0
75%	58	16.0	75	20.4	92	40.0
100%	42	9.1	33	11.0	63	15.6

The superiority of plants grown in the steamed soil and the similarity of those grown in the washed and untreated soils indicated that soluble salts or toxins were not primarily concerned in the root rot problem.

Both extremes of moisture used in this experiment were beyond the range favorable for plant growth. Cane grown in the washed soil at 25 percent of the water-holding capacity was better than that in the untreated and steamed soils, because, in washing, a considerable amount of silt and clay was removed. This gave the plants more available moisture, as the water-holding capacity was based on untreated soil. The plants in the steamed soil of the intermediate moisture contents (Figs. 3 and 4) were not only nearly twice as tall as those growing in the untreated and washed soils, but also were more vigorous and of a deeper green color. Roots in the steamed soil were healthy, while those in the washed and untreated soils were badly rotted. The best growth in the washed and untreated soils was obtained in the 50 percent moisture series, while that in the steamed

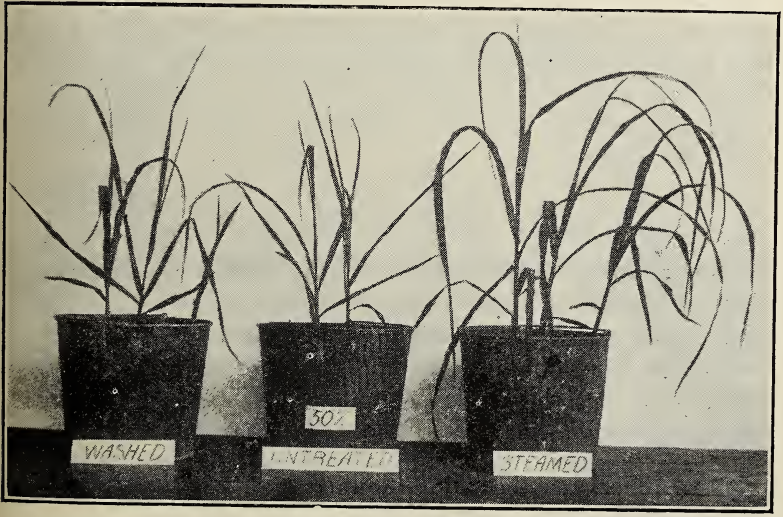

Fig. 3. Growth of Louisiana Purple cane in washed, untreated and steamed seepage soil, held at 50 percent of its water-holding capacity. Greenhouse, January 24 to April 10, 1928.

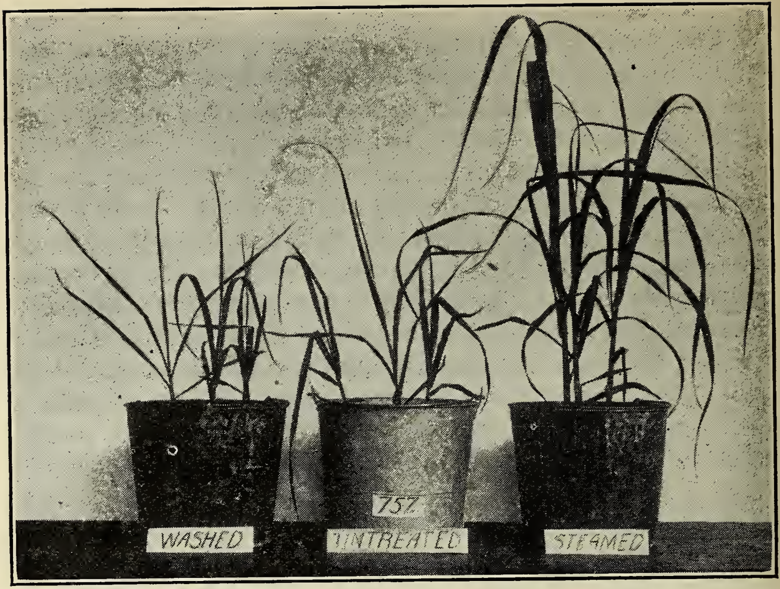

FIG. 4. Growth of Louisiana Purple cane in washed, untreated, and steamed seepage soil, held at 75 percent of its water-holding capacity. Greenhouse, January 24 to April 10, 1928.

soil was at 75 percent. This indicates that cane grows best at a relatively high soil moisture content when the soil is free from parasitic organisms; but when parasitic organisms are present, a lower moisture content of the soil is more satisfactory.

NEMATODES

A survey of the cane producing regions of Louisiana has revealed two types of nematodes inhabiting cane roots. One, the gall forming root knot nematode, *Heterodera radicicola,* was found very sparingly in widely scattered regions in sandy soil, while the other which has not been identified, but is similar to *Tylenchus similis* (Cobb) was found to be almost universally distributed, though no cases of severe infestation were found. Attempts to obtain these nematodes in pure culture were unsuccessful.

The effect of variations in soil moisture on the development of root knot of sugar cane was studied in the greenhouse. It was found that the root knot nematodes from cane readily infested tomato. In order to preclude to some extent the effects of other organisms which might be found on cane roots, galled roots of tomatoes that had been inoculated with nemas from cane were used as inoculum. A mixed soil sterilized for two hours at 15 pounds pressure was used. Three single eye pieces of Louisiana Purple cane were planted in each 10-quart pail of soil. Four pails were used at each moisture variation. To obtain the effect of temperature, one series was planted in July and another in October. The data obtained from these tests are given in Table 3.

TABLE 3.

EFFECT OF MOISTURE ON GROWTH OF LOUISIANA PURPLE CANE IN SOIL INFESTED WITH THE ROOT KNOT NEMATODE, HETERODERA RADICICOLA.

Percent water-holding capacity of the soil	AVERAGE HEIGHT OF STEMS IN INCHES			
	July 18 to Sept. 13, 1927		Sept. 26 to Dec. 11, 1927	
	Check	Heterodera	Check	Heterodera
25	5.3	5.8	6.5	4.7
45	9.0	7.9	9.1	8.0
65	8.6	8.7	8.5	7.7
85	11.7	11.4	8.2	8.2

The results indicate that injury due to the root knot nematode increases as the water content of the soil decreases. While typical galls were found on inoculated plants at all moisture variations (Fig. 5), an examination of the roots after the soil had been washed away, showed that they were more abundant on the plants grown in soils kept at the intermediate moisture contents than on those growing in the wettest or driest soils. Galls were most prevalent on the tips of both primary and secondary roots. Roots so affected ceased growth, and this stunting of the roots seemed to be the principal form of injury.

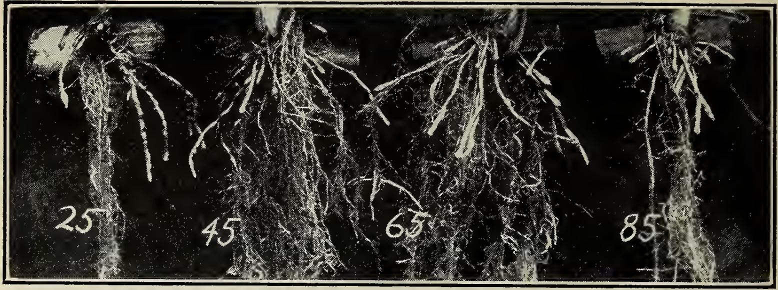

FIG. 5. Gall development on roots of Louisiana Purple cane produced by nematode, *Heterodera radicicola.* Plants grown in nematode infested soil and held at 25, 45, 65 and 85 percent of its water-holding capacity. Greenhouse, September 26 to December 13, 1927.

SOIL ANIMALS OTHER THAN NEMATODES

Another phase of the sugar cane root rot problem is that of injury to the roots by soil inhabiting animals. The most evident form of this injury is the presence of small pits which penetrate directly into the root. These pits are usually circular in shape and most of them do not penetrate beyond the cortex. Not more than five percent (15) of the pits extend into the stele. At first the pits are clean cut and show little discoloration, but later the tissue around them turns a reddish or brownish color. Pitting occurs universally throughout the sugar cane area of Louisiana and freshly made pits have been observed at all seasons of the year except during cold weather. A less conspicuous form of injury, due to soil animals, is the eating off of the root tips, especially those of the secondary and tertiary roots. While a number of soil animals may be concerned with root injury, there is evidence (39) that the Collembolous insect, *Lepidocyrtus violentus,* commonly called springtail, is the most important. Besides the direct injury to the roots, it has been suggested that the pits may serve as avenues of entrance for root rotting fungi, such as Pythium.

Experiments to determine the relative importance of root pitting insects and a parasitic species of Pythium were conducted during 1928. Sugar cane was grown at different seasons of the year in the greenhouse in 10-quart pails of steamed soil. Some of these were left uninoculated, while others were infested or inoculated with *Lepidocyrtus violentus* alone, *Pythium sp.* alone, and *Lepidocyrtus violentus* and *Pythium sp.* together. Two series were completed, one in the spring and the other in the summer. Four pails of each treatment were used and three single eye pieces of Louisiana Purple cane planted in each pail. Pythium inoculations were made immediately before planting by thoroughly mixing a three-day-old culture of a parasitic Pythium with the soil. The *Lepidocyrtus violentus* infestations were made by adding 50 of the insects to each pail immediately after planting. The soil was kept at about 60 percent of its water-holding capacity by weighing the pails regularly. The results are given in Table 4.

TABLE 4.

THE INFLUENCE OF PYTHIUM AND LEPIDOCYRTUS VIOLENTUS (Folsom) ON THE GROWTH OF LOUISIANA PURPLE CANE IN STERILIZED SOIL IN THE GREENHOUSE.

Treatment	Feb. 7 to Apr. 11, 1928			July 7 to Sept. 17, 1928		
	Percent germination	Length of stem in inches	Percent of plants stooling	Percent germination	Length of stem in inches	Percent of plants stooling
Check	92	7.0	0.0	92	13.7	75
Lepidocyrtus violentus	92	6.1	0.0	100	13.8	75
Pythium	100	3.2	0.0	83	12.1	60
Lepidocyrtus violentus and Pythium	75	2.3	0.0	92	10.7	33

The results of these tests indicate that root pitting animals, such as *Lepidocyrtus violentus,* may retard cane growth and aggravate injury due to Pythium. Their influence on growth was greater under the cool growing conditions of spring than under those of summer. An examination of the soil and the roots showed that the insects had increased greatly in numbers, and although there was not a great deal of pitting, there was a decrease in the number of secondary roots (Figs. 6 and 7).

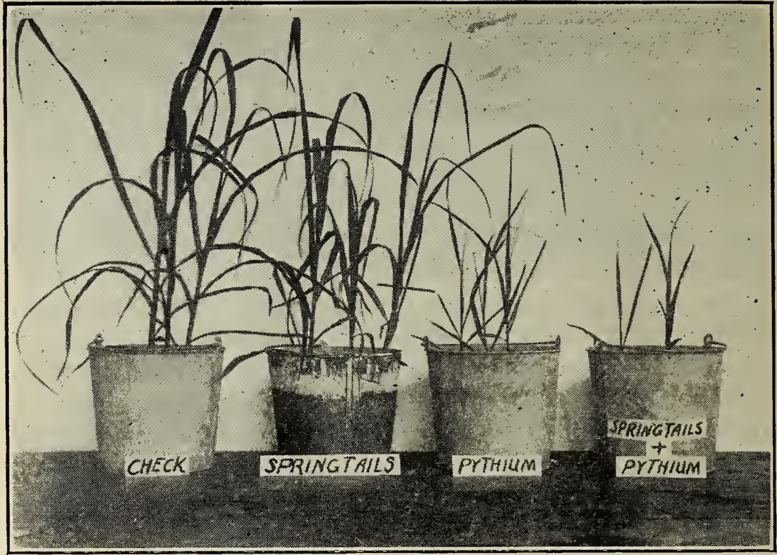

FIG. 6. Effect of springtails, *Lepidocyrtus violentus*, and Pythium on the growth of Louisiana Purple cane in steamed soil held at 60 percent of its water-holding capacity. Greenhouse, February 7 to April 10, 1928.

SOME FACTORS INFLUENCING THE PARASITISM OF ROOT ROTTING ORGANISMS

While it has been demonstrated quite conclusively that certain fungi, especially species of Pythium and Rhizoctonia, have the ability to attack and rot roots of sugar cane and corn, the conditions favorable or unfavorable for this attack have not been definitely established. Previous experiments in Louisiana (16) have shown that root rotting species of Pythium are abundant in most of the cane soils, yet, the severity of the root rot disease varies to a great extent from year to year. These organisms are known to be facultative parasites, living readily on both dead organic matter and living plants. Their ability to seriously injure the host seems to depend upon environmental conditions, as well as upon the thriftiness or vitality of the latter. To obtain some idea of the conditions which favor or retard the action of these organisms, a study has been made of the effect of moisture, temperature, and soil acidity on both parasite and host.

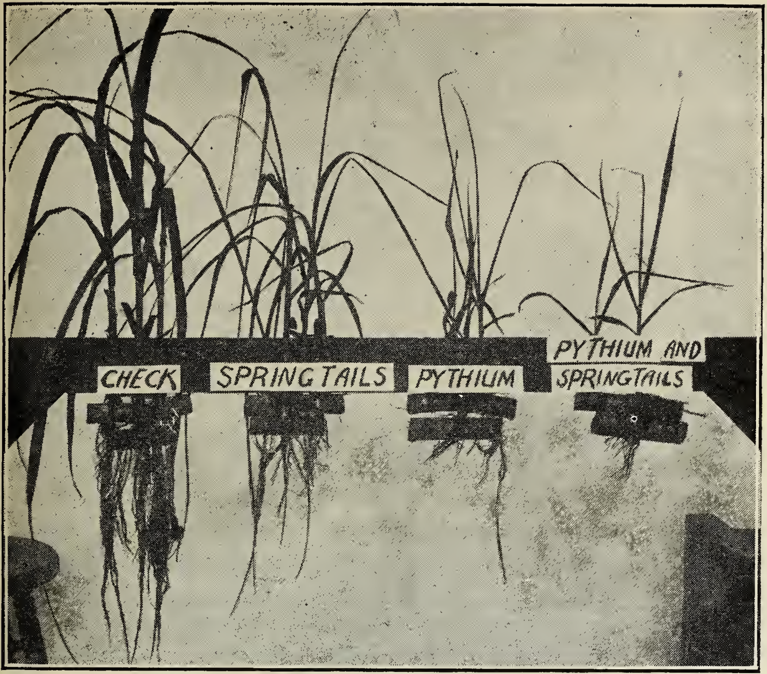

FIG. 7. Effect of springtails, *Lepidocyrtus violentus,* and Pythium on root development of Louisiana Purple cane in steamed soil held at 60 per-cent of its water-holding capacity. Greenhouse, February 7 to April 10, 1928.

MOISTURE AND TEMPERATURE RELATIONS

The sugar cane plant is a native of the tropics and is subjected to abnormal weather conditions when grown in Louisiana. These conditions may influence the crop directly by the effect on the growth and development of the cane plant, or indirectly, by providing favorable conditions for the development of parasites.

McDonald (31) has shown that high yields of sugar per acre in Louisiana are directly correlated with high winter temperature, especially in March, and low winter rainfall; while Edgerton and Tims (15) have shown that high yields have followed winters (January, February and March) of low rainfall, and low yields winters of high rainfall. It has also been frequently observed that the effects of root rot are more noticeable in dry summers following wet winters. In seasons of ample rainfall, even a deficient root system is able to absorb sufficient water for plant growth.

In order to test under controlled conditions the effect of soil moisture and temperature on the severity of root rot as produced by the important root rotting fungi, Pythium and Rhizoctonia, a number of tests were conducted in the greenhouse and laboratory. These were run with both cane and corn. As has been previously shown, these parasites attack corn roots as readily as those of cane.

In one experiment with sugarcane, plants were grown in pails at different seasons in order to test variations in temperature. One set was started in July and another in October. Pails containing mixed sugarcane soil were autoclaved for two hours at 15 pounds pressure. These were then inoculated by mixing into the soil three-day-old petri dish cultures of Pythium and Rhizoctonia. Three single-eye seed pieces of Louisiana Purple cane were planted in each pail and four pails of each variant were used. Water was added to bring the soil to the required moisture content and the soil was maintained at this moisture content thereafter by weighing regularly. When the plants had about reached their maximum growth in the containers, they were measured and the roots were washed free of soil and examined for decay. The results obtained are given in table 5.

TABLE 5.

THE EFFECT OF MOISTURE ON THE GROWTH OF LOUISIANA PURPLE CANE IN STERILIZED SOIL, INOCULATED WITH PYTHIUM AND RHIZOCTONIA.

Percent moisture-holding capacity of soil	AVERAGE HEIGHT OF STEMS IN INCHES					
	Summer series			Fall series		
	July 18 to Sept. 13, 1927			Sept. 26 to Dec. 11, 1927		
	Check	Pythium	Rhizoctonia	Check	Pythium	Rhizoctonia
25	5.3	5.4	5.5	6.5	3.5	6.7
45	9.0	9.0	8.9	9.1	5.1	9.2
65	8.6	8.5	9.5	8.5	8.7	9.6
85	11.7	9.6	10.3	8.2	6.6	9.0

The data in table 5 show that under greenhouse conditions Rhizoctonia had little effect on the growth of Louisiana Purple cane during either the hot summer months or the cooler months of fall. Pythium had little effect during the summer, but in the fall, the plants in the Pythium inoculated soil averaged somewhat smaller than the controls. The summer temperature in the greenhouse, which was somewhat higher than in the open, evidently retarded the development of the Pythium on the cane roots.

Although inoculating the soil with Rhizoctonia had little effect on the growth of the cane, an examination of the roots showed an abundance of the dark brown lesions. These lesions, however, had not caused any marked reduction in root development.

The effect of Pythium on root development was quite variable. The soft, flaccid root tips characteristic of Pythium rot were present in all soil moisture concentrations in the summer and fall. In the summer series, there was little effect on the total root production, but in the fall series, Pythium reduced the quantity of roots. In the soil kept at 65 percent, the effect was not so noticeable.

Two tests were also made to determine the effect of Pythium on POJ 213 cane. Sterilized soil was used and the moisture content in different sets was held at 20, 30, 40, 50, 60, 70, 80 and 90 percent of its water-holding capacity. The tests were started in May and July, 1928. The results of the tests are given in table 6.

TABLE 6.

THE EFFECT OF MOISTURE ON THE GROWTH OF POJ 213 CANE IN STERILIZED SOIL INOCULATED WITH PYTHIUM.

Percent moisture-holding capacity of the soil	AVERAGE HEIGHT OF STEM IN INCHES			
	May 2 to June 25, 1928		July 19 to Aug. 17, 1928	
	Check	Pythium	Check	Pythium
20	0.0	0.3	0.0	0.0
30	4.5	4.5	6.3	7.0
40	5.4	6.5	8.5	8.3
50	8.2	8.4	11.0	10.0
60	11.9	10.8	14.7	14.0
70	12.6	11.4	16.6	14.0
80	12.3	11.9	17.3	16.6
90	0.0	0.0	20.1	16.3

During hot weather, Pythium had practically no effect on the growth of sugarcane in the drier soils, while in the wetter soils, there appeared to be a slight, but constant, decrease in growth.

TESTS WITH CORN

To determine the effect of soil moisture and temperature on the development of Pythium root rot of corn, a series of tests was run in the greenhouse in the spring of 1928. Cans of No. 2 size were filled with a mixed cane soil and autoclaved for two hours at 15 pounds pressure. A three-day-old petri dish culture of a parasitic sugarcane Pythium (No. 931) served as inoculum for each can. Ten surface sterilized corn seeds of the variety, Calhoun Red Cob, were planted in each can and water added to bring the soil to the desired moisture content. Four replications of each variant were used. The tests were started in March, April, May and June, thus giving comparisons of early spring and summer temperatures. The soil temperature in the greenhouse during the test period ranged in March from 56°F to 67 with a mean of 60; in April, from 51 to 72 with a mean of 63; in May, from 65 to 79 with a mean of 71; and in June, from 75 to 88 with a mean of 82. The germination of the seed and the height of the plants were used as criteria for Pythium injury. The results of these tests are given in tables 7 and 8.

TABLE 7.

INFLUENCE OF SOIL MOISTURE AND TEMPERATURE ON GROWTH OF CORN IN PYTHIUM INFESTED SOIL.

Percent of water-holding capacity of the soil	AVERAGE LENGTH OF TOPS IN CM.							
	March 1 to 11		April 2 to 21		May 2 to 21		June 8 to 19	
	Check	Pythium	Check	Pythium	Check	Pythium	Check	Pythium
20	5.6	4.3	3.0	3.0	8.5	7.5	4.6	3.3
30	12.2	8.1	10.9	11.9	18.7	16.9	8.3	6.3
40	14.9	9.8	16.5	12.7	26.4	22.3	16.2	13.1
50	17.2	10.8	20.9	12.1	34.0	22.2	23.1	19.9
60	17.8	10.3	25.0	11.6	38.4	19.7	26.7	18.5
70	18.3	8.1	22.6	9.1	36.4	16.3	28.3	18.4
80	18.9	10.0	23.4	8.5	38.8	11.5	29.6	17.2
90	14.5	0.0	20.6	0.0	0.0	0.0	28.6	15.4
100	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

TABLE 8.

INFLUENCE OF SOIL MOISTURE AND TEMPERATURE ON GERMINATION OF CORN IN PYTHIUM INFESTED SOIL.

Percent of water-holding capacity of the soil	PERCENT GERMINATION							
	March 1 to 11		April 2 to 21		May 2 to 21		June 8 to 19	
	Check	Pythium	Check	Pythium	Check	Pythium	Check	Pythium
20	12.5	7.5	2.5	10.0	77.5	75.0	12.5	10.0
30	95.0	92.5	87.5	77.5	97.5	90.0	27.5	45.0
40	100.0	95.0	97.5	90.0	90.0	95.0	92.5	80.0
50	97.5	80.0	97.5	85.0	92.5	90.0	97.5	95.0
60	87.5	55.0	80.0	57.5	85.0	77.5	90.0	95.0
70	77.5	37.5	62.5	32.5	80.0	45.0	97.5	95.0
80	70.0	15.0	30.0	20.0	12.5	17.5	85.0	72.5
90	35.0	0.0	12.5	0.0	0.0	0.0	67.5	40.0
100	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

The data in table 7 show that reduction in growth due to Pythium was most pronounced during the cooler months and in the wetter soils. Soil kept at 20 and 30 percent of its water-holding capacity was too dry, while that at 90 and 100 percent was too wet for the growth of corn. Best growth of corn was obtained in the Pythium series when the soil was kept at 50 percent of its moisture-holding capacity, while in the check series, a moisture-holding capacity of 60 and 70 percent was best.

The injury due to Pythium increased with the moisture content of the soil and was more pronounced at a lower moisture content during the cool months than during the warm months. In March, April, and May, the corn growing in Pythium infected soil kept at 50 percent of its water-holding capacity was only about 60 percent as tall as the check; while in June, it was 85 percent.

The germination results are quite regular except at the extreme moisture variations where the soil was too dry or too wet. Germination was not materially affected in any of the tests in Pythium inoculated soil held at 30 and 40 percent of its water-holding capacity (Figs. 8, 9). In the series conducted during the cool months of March

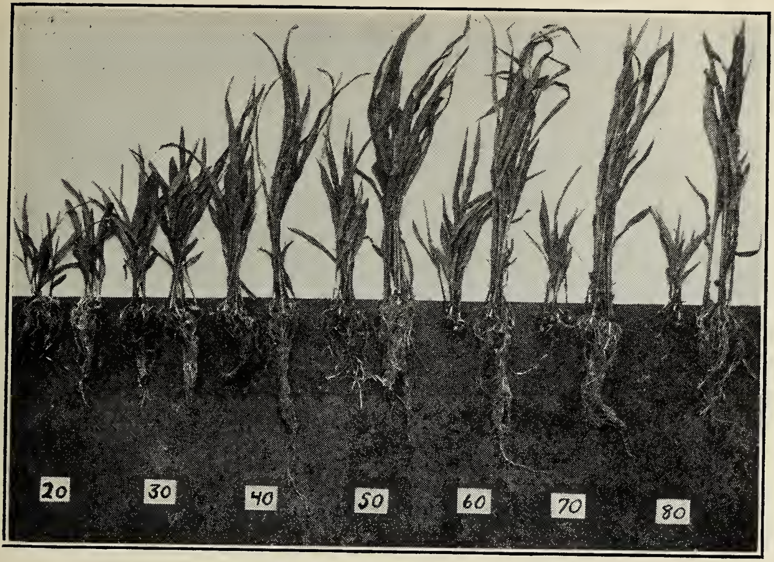

FIG. 8. Effect of moisture on Pythium root rot of corn. Grown in the greenhouse from May 2 to May 21, 1928, in steamed soil with moisture content ranging from 20 to 80 percent of its water-holding capacity. Of each pair, Pythium inoculated plants on left and control on the right.

and April, there was a noticeable reduction in germination at 50 percent in the Pythium infested soil; in the May series, this reduction was evident at 60 percent; while in June, the 80 percent Pythium infested soil was the first to show a significant reduction in germination. These trials indicate that both the growth and germination of corn in Pythium infested soil are closely correlated with soil moisture and temperature.

To determine more accurately the effect of temperature on the rotting of roots by Pythium, corn was grown in No. 2 metal cans in temperature controlled incubators. The cans were filled with soil and autoclaved for two hours at 15 pounds pressure. They were then inoculated with two similar strains of Pythium, 931 and 1432. Culture 931 had been growing in the laboratory for two years and its virulence was known to be decreasing (16). A single three-day-old petri dish culture on bean pod agar was used as inoculum for each can, this being mixed

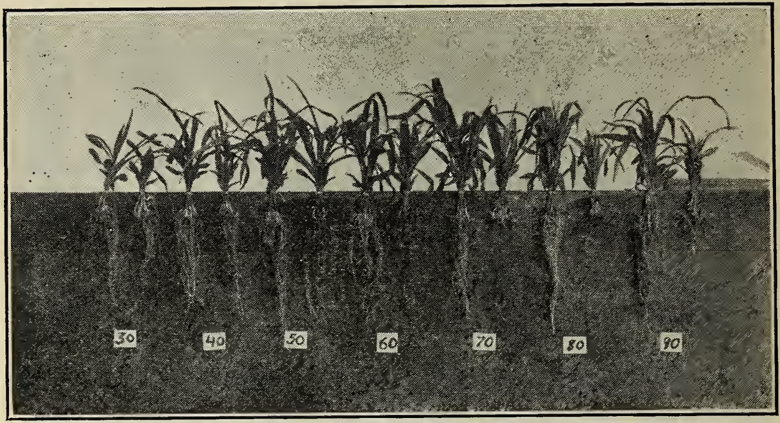

FIG. 9. Effect of moisture on Pythium root rot of corn. Grown in the Greenhouse from June 8 to June 19, 1928, in steamed soil with moisture content ranging from 30 to 90 percent of its water-holding capacity. Of each pair, Pythium inoculated plants on right and control on the left.

thoroughly with the soil three days before planting. A sterile plate of bean pod agar was mixed with the soil in the control cans. Five germinating corn seedlings of the variety, Calhoun Red Cob, were planted in each can. Three cans of each Pythium and the same number of checks were grown at each temperature. The soil was maintained at 60 per cent of its water-holding capacity by weighing daily. The results obtained in this test are given in table 9.

TABLE 9.

INFLUENCE OF TEMPERATURE ON GROWTH OF CORN IN PYTHIUM INFESTED SOIL IN TEMPERATURE INCUBATORS.

Temperature ° C	Period of growth	Average length of tops in CM.			Percentage decrease	
		Check	931	1432	931	1432
35	5	24.2	25.8	22.2	6*	8
30	5	30.0	23.5	19.0	22	37
26	5	26.8	15.4	12.0	43	55
23	5	17.4	12.2	10.8	30	38
20	10	30.0	19.0	19.6	37	35
15	20	19.5	10.1	9.3	48	52

*Increase.

Both strains of Pythium were severely parasitic at the intermediate and lower temperatures, but at the higher temperatures, 931 which had been in culture for three years appeared to be less injurious than 1432 which had been in culture only one year. A temperature of 35°C was too high for best growth of corn; but at this temperature, there was very little rotting of the roots (Fig. 10F). At 30°C the corn grew best, although there was considerable Pythium injury. At this temperature, the tops of the corn grown in the Pythium infested soil were appreciably shorter than the controls and the roots were considerably rotted (Fig. 10E). The main roots were discolored and many of the tips had the soft, flabby rot, characteristic of Pythium. There were very few secondary and tertiary roots, and these were rotted severely, being only short protuberances from the main root. With each reduction in temperature from 30° to 15°C, the corn growth was less; and the Pythium injury was more severe (Figs. 10 A-D). At 15°C, even the main roots were rotted off nearly to the seed.

Another form of Pythium injury also appeared on the corn grown at the lower temperatures. In a number of cases, there was a rot of the mesocotyl and the stem above the seed, and the Pythium mycelium was found in the decayed areas. This type of injury was not found on corn grown at temperatures above 23°C. An occasional plant was found partially rotted at 23°C, but at 20° and 15°C, this type of rotting was quite prevalent.

TEMPERATURE STUDIES OF PYTHIUM SPECIES IN CULTURE

The effect of temperature on the growth of sugarcane Pythiums in culture was also determined. Portions from the margins of rapidly growing cultures were transferred to petri dishes of Difco dextrose agar and the increase in diameter of the colonies measured at 12-hour intervals. The cultures were grown in incubators with a range of temperature between 15° and 36°C. Eight different cultures of Pythium were used. Four of these, 931, 1432,

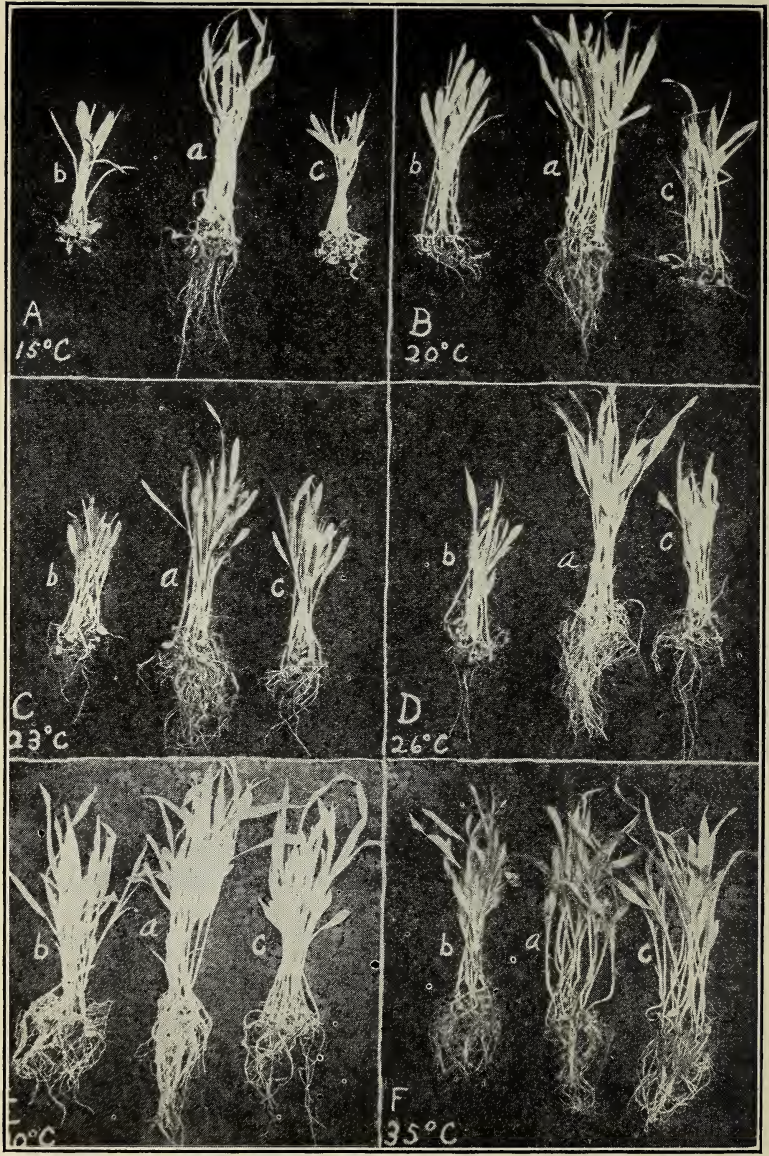

FIG. 10. Effect of temperature on Pythium root rot of corn. Grown in temperature controlled incubators ranging from 15 to 35°C. a. Controls, not inoculated, b. and c. Plants from soil inoculated with Pythium cultures, 1432 and 931.

A and B were strongly parasitic cultures isolated from cane in Louisiana. Another, 1285, came from Hawaii, supposedly the organism responsible for the Lahaina disease, a disease similar to the root rot which occurs in Louisiana. Two of the other cultures, C and 1436, while isolated from cane in Louisiana, were only mildly parasitic. The eighth culture, D, was a weak-growing, non-parasitic form. The results are shown in table 10.

TABLE 10.

RATE OF GROWTH OF SEVERAL PYTHIUMS ISOLATED FROM SUGARCANE ROOTS AT VARIOUS TEMPERATURES ON DEXTROSE AGAR.

Temperature ° C	CULTURE DESIGNATION							
	Average Increase in Diameter of Colony in 12-Hour Period							
	931	1432	1285	A	B	C	1436	D
15	1.3	1.1	1.1	1.0	0.9	0.9	0.9	0.7
20	2.1	2.0	1.9	1.8	1.7	1.9	2.1	0.8
25	2.5	2.6	2.6	2.6	2.5	2.5	3.2	1.0
30	2.8	2.9	2.9	2.9	2.9	3.2	4.0	1.1
36	1.4	1.7	2.0	1.7	1.4	2.5	3.2	0.5

All the parasitic strains showed considerable similarity in rate of growth; the rate of growth of all these increasing with the temperature up to 30°C and falling off considerably at 36°C. The slightly parasitic forms had an optimum in the neighborhood of 30°C, but made good growth at 36°C. The non-parasitic form grew slowly at all temperatures. While the differences in the rate of growth of the parasitic forms were slight, the results indicated that culture 931 grew better at the lower temperatures than did 1432; while at the higher temperatures, the reverse was true. These two cultures had been used in inoculation experiments and were known to act in a similar way; 931, however, had been in culture for three years, while 1432 had been grown for only one year.

RELATION OF H-ION CONCENTRATION TO GROWTH

Investigations at the Louisiana Agricultural Experiment Station had shown that parasitic cultures of Pythium could rarely be isolated from cane roots when plated on acidified agar. Many fungi make a satisfactory growth in acid media, and as Pythium seemed to differ in this respect, it was thought desirable to obtain more accurate information as to its growth under conditions of varying H-ion concentration.

The fungus was grown on several different culture media with the hydrogen-ion concentration ranging from 4.6 to 9.6. The results have been published in another article (17). It was found that the fungus would not grow at an initial pH of 4.6 or less. At 5.6, it grew slowly at first, but subsequently caught up with cultures growing at a more favorable hydrogen-ion concentration. It made the most satisfactory growth in culture media with the initial pH ranging from 6.5 to 8.6. At a pH of 9.6, growth started slowly, but at the end of four weeks, the fungus had produced as much mycelium as it did in media with a more favorable hydrogen-ion concentration.

It was also found that the metabolic products of fungous growth changed the pH of the media towards 6.0 regardless of the initial H-ion concentration. This tendency to change the pH towards 6.0 continued as long as the mycelial felt increased in weight. After maximum growth had been reached, the solutions uniformly became alkaline.

As most of the soils in the sugar belt of Louisiana have a H-ion concentration ranging between 6.0 and 7.5, conditions are very favorable for the rapid growth and development of the sugarcane Pythium.

STUDIES OF PHYSIOLOGY OF INFECTION

At it has been repeatedly demonstrated that species of Pythium are able to rot the roots of sugarcane and corn growing in sterile soil, it has been assumed that these fungi can gain entrance to the root without the assistance of other agencies. In view of the lack of definite information on this phase of the problem, a study was undertaken to determine if possible the manner in which the fungus enters the root, the influence of the age of the root on the penetration of the fungus, and the rapidity of penetration through the root tissues.

Hawkins and Harvey (20) in a study of the parasitism of *Pythium debaryanum* on the potato tuber showed that the fungus secreted a toxin which killed the cells of the potato. It also secreted an enzyme which dissolved the middle lamella, but had little effect on the secondary thickenings. These authors also showed that varietal resistance to the disease was correlated with resistance to mechanical puncture, and concluded that mechanical pressure exerted by the fungous hyphae seemed to be the most important factor in cell wall penetration. Microscopical observations of cell wall penetration by the fungous hyphae seemed to corroborate this theory.

Lee, et al (28), in connection with Pythium root rot of sugarcane in Hawaii state: "Injury from the fungus apparently results from the disintegration of the tissues of the root caused by the toxins given off by the fungus growing in both the cortex and stele of the root. There is very little known of the means of ingress of the fungus into the roots, but apparently in the roots of the Lahaina variety, penetration is possible wthout previous mechanical injury or without the aid of such small animals as nematodes, centipedes, etc."

Preliminary investigations on the physiology of infection showed that there were two types of rots of sugarcane and corn caused by Pythium fungi. One of these, which is caused by the semi-parasitic fungus, produces a cortex rot and does not enter the central cylinder of the root. This fungus kills the cortex cells, but the cells do not collapse; on the contrary, they become hard in contrast to the soft rot produced by the more parasitic Pythium. The lesions produced by this fungus are greyish to a yellowish brown in color. The second type of rot is produced by the more parasitic Pythium and is of more economic importance in Louisiana. It attacks the central cylinder of the root as well as the cortex, and produces a soft rot with a collapse of the root cells. This fungus is mainly responsible for the soft, flabby root tips and the lack of secondary roots.

To determine how the parasitic Pythium enters and grows in the root tissues, tests were made using roots of corn seedlings. Corn seeds were treated in a 1-400 solution of Uspulun at 52°C for one hour, washed in sterile water, dipped in 95 percent alcohol and flamed, and then germinated on moist filter paper in sterile petri dishes. This treatment rendered most of the seedlings sterile. The rate of penetration of the tissues of the seedling corn root by Pythium was studied in the region of the root just back of the root cap, and in portions that were 16 and 48 hours old. In the study of infection on tissues 16 and 48 hours old, the roots were marked just back of the growing point with India ink 16 and 48 hours respectively, before they were inoculated. Inoculations were made by placing just back of the root tip and at the 16 and 48-hour ink marks one-eighth inch strips of medium and mycelium taken from a three-day-old culture of the fungus on bean pod agar. At intervals of 2, 4, 6, 8, 12 and 24 hours, after inoculation, portions of the root were removed and fixed in a solution composed of 100 cc. of 50 percent ethyl alcohol, 6.5 cc. of formaldehyde, and 2.5 cc. of acetic acid. These were imbedded in paraffin, sectioned, stained in cotton blue, and mounted in gum damar.

Sections made from roots inoculated just back of the root tip showed that infection had been unusually rapid. Within two hours, the Pythium had entered the epidermal cells. In four hours, the first three or four tiers of cells had been penetrated, and in six hours, the fungus had nearly reached the central cylinder. In eight hours, the central cylinder had been reached, but the root tip had not been killed or penetrated. In twelve hours, the central cylinder had usually been penetrated and the fungus hyphae were spreading into the root tip. By twenty-four hours, the root tip had been completely invaded by the hyphae of the fungus, and the cells had collapsed.

The method of original penetration is not entirely clear but seems to be due to a combination of a disintegration of the outside walls of the epidermal cells and penetration by force. Hyphae have never been observed entering unbroken epidermal cells of a root. The point of entrance is usually where there is a slight depression in the contour of the root. Swollen, knob-like structures, resembling appresoria have been seen at the region where the fungus entered the root, but penetration seems always to be accompanied by the breaking down of the epidermal cells. Once within the root, the fungus spreads out in a fan-like manner, uninfluenced by the cell walls and contents, until the central cylinder is reached. The endodermis and pericycle offer considerable resistance to penetration. Even in the inoculations of the youngest portion of the root, cases were observed in which penetration of the central cylinder had not been effected in 24 hours, although in all cases examined, hyphae had reached the central cylinder in 8 hours. Usually, however, the central cylinder was penetrated by the end of 12 hours and in 24 hours was completely invaded.

Penetration of the cortex tissues that were 16 hours old when inoculated was nearly as rapid as when the inoculation was made just back of the root tip. Within six hours, the hyphae had reached the central cylinder. The central cylinder of these roots, however, checked the growth of the Pythium to some extent. At the end of 12 hours, there was no evidence of penetration and after 24 hours the fungus had gained entrance to only the outer three or four layers of cells of the central cylinder.

The uninjured cortex of roots that were 48 hours old at the time of inoculation was not readily penetrated by the fungus. Even where it did get in, as around the regions ruptured by the protrusion of the secondary roots, growth was exceedingly slow and only the three or four layers of cortical cells immediately adjacent to the secondary root were invaded after 24 hours. The secondary roots were, in all cases, rotted off to the surface of the primary root; but at the end of 24 hours, the hyphae had not been observed to have gained entrance to the central cylinder of the primary root via the secondary roots. It is evident that most of the infection occurs on the very young tissues.

DISCUSSION

Many ideas and theories have been advanced to explain the failure of certain cane varieties, and it is reasonable to assume that a number of factors are concerned in the problem. Diseases, insect pests, soil fertility and climatic conditions are all factors which must be considered. Also, it must be recognized that the combination of factors responsible for crop failures in one country may not necessarily be the same as in another country.

Among the possible causes for the failure of cane crops is the group of troubles commonly known as root rot, root rot complex, or growth failure complex. In this group are included all factors which may cause a decay or deterioration of the root system or prevent the roots from functioning properly. In this bulletin, the results of investigations on certain phases of the root rot problem have been presented.

It has been shown that the failure of the sugarcane crop has not been due to the running out or deterioration of the old varieties. The yields of from 30 to 35 tons per acre of D74 and Louisiana Purple cane which have been obtained in the Experiment Station fields disprove this idea. Furthermore, it has been shown that seed stalks from stools severely affected with root rot recover when planted in good soil, and produce thrifty plants. Even rhizomes from a severely diseased stool recovered when planted in steamed soil, and produced plants nearly as tall and vigorous as did rhizomes from healthy stools.

Furthermore, no evidence has been obtained to support the theory that growth failure in Louisiana is due to the accumulation in the soil of excessive amounts of salts or toxins. The addition of relatively large amounts of the sulphate salts of aluminum, calcium, iron (ferric), and magnesium had no appreciable effect on the growth of cane. Cane planted in a soil, taken from beneath stools severely affected by root rot, and repeatedly washed so as to remove soluble salts and toxins, grew no better than did that growing in the untreated soil. However, cane planted in part of this same soil that had been steamed for two hours grew much better than that planted in either the washed or untreated soils.

Since neither senility nor the accumulation of toxic substances in the soil appeared to be important factors in the growth failure problem, it seemed evident that the attack of soil organisms was at least one of the important factors in the problem. Soil organisms which were studied included nematodes, other soil animals, and certain fungi.

Two species of nematodes, whose status in the root rot problem have not yet been definitely ascertained, were found in the roots of sugarcane. One of these, the root knot nematode, *Heterodera radicicola* (Muller), was found only a few times in sandy soil in widely scattered regions of the sugar belt. The other nematode has not yet been identified but resembles *Tylenchus similis* (Cobb). This nematode was found in cane roots in nearly all regions of the sugar belt and in all types of soil. No cases of infestation severe enough to cause serious injury to the cane plants were observed, and it is thought that the nematode factor is not of primary importance.

Certain soil inhabiting animals, such as *Lepidocyrtus violentus,* pit the roots of sugarcane and mutilate the root tips. These animals appear able to injure the growth of cane to some extent on their own account, and when present in soil infested with Pythium, are able to increase the injury caused by the latter. Consequently, they appear to have a bearing on the root rot problem but their actual importance has not been ascertained.

Fungi have long been associated with the root rot disease and a great many different forms have, at one time or another, been reported on decaying roots. Of these, species of Pythium are at present considered to be the most important. Earlier investigations had shown that there are a number of species or strains of Pythium which are widely distributed in the cane belt of Louisiana. Certain of the parasitic forms are capable of completely rotting the roots of both cane and corn. The roots become soft and flaccid; and all the tissues, including the central cylinder, are invaded.

Some of the conditions which favor the development and infection with Pythium have now been determined. Root rot of corn and cane by Pythium is favored by lower temperatures and by a high moisture content of the soil. This is in agreement with the general observations on the root rot disease, that it is more severe following cold, wet winters. Excessive moisture in the summer does not cause as much harm as in the winter and spring. These facts emphasize the importance of good drainage, especially during the winter season, and also the importance of removing the dirt from the cane in the spring so that the soil around the roots will become warm.

In regard to soil acidity, it was found that the Pythium grows satisfactorily in solutions with the hydrogen-ion concentration ranging from 5.5 to 9.2. Most of the cane soils in Louisiana come within this range.

SUMMARY

1. The growth failure or root rot complex of sugarcane in Louisiana is not due to the running out or deterioration of the old varieties of cane.
2. No evidence was found to indicate that inorganic salts or soluble toxins are concerned in the root rot problem. Washing the soil had no effect on the growth of sugarcane, but steaming the soil made conditions favorable for a more rapid growth.
3. The root knot nematode, *Heterodera radicicola* (Muller), and a burrowing nematode, similar to *Tylenchus similis* (Cobb), were found in the roots of sugarcane in Louisiana, but never in sufficient quantities to be a major factor in the root rot problem.

4. *Lepidocyrtus violentus* (Folsom), a soil-inhabiting, root-pitting insect slightly injured the growth of cane in steamed soil. In Pythium-infested soil, this insect seemed to increase the injury caused by Pythium.
5. A species of Rhizoctonia produced discolored lesions on the roots of sugarcane but did not appreciably reduce growth.
6. A species of Pythium was severely parasitic on the roots of sugarcane and corn, and was injurious to the growth of the plants.
7. Pythium injury to germination and growth of corn increased with the water content of the soil. Injury was less severe in wet soils in warm than in cool weather.
8. Pythium injury to germination and growth of corn decreased with rise in temperature. At 35°C, Pythium did not injure corn. At 30°C, there was an appreciable amount of injury, and at lower temperatures, injury was severe.
9. In culture solutions, Pythium was sensitive to acidity and tolerant to alkalinity. It did not grow in solutions of pH less than 5.2 or greater than 10.0. It grew well within the pH range of 5.5 to 9.2.
10. The semi-parasitic Pythium produced a cortex rot and did not enter the central cylinder. The cortical cells were killed and became hard. The lesion became greyish to yellowish in color.
11. The parasitic Pythium invaded all the tissues of the young roots and produced a soft rot with a collapse of the root cells.
12. The fungus appeared to enter the young roots through a combination of the disintegration of the outside walls of the epidermal cells and penetration by force. Once within the root, the progress of the fungus was rapid, seemingly, uninfluenced by the cell walls until the central cylinder was reached. The

central cylinder offered considerable resistance to invasion; but in young roots, it was usually overrun by the fungus in 24 hours.

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MAY, 1930 LOUISIANA BULLETIN No. 213

BLACKBERRY AND MUSCADINE GRAPE CULTURE AT HAMMOND, LOUISIANA

BY
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BLACKBERRY CULTURE

B. SZYMONIAK, Horticulturist In Charge

The blackberry and dewberry plants grow wild throughout Louisiana, yet only few are grown commercially, due to the fact that the wild varieties are not generally suited to shipping. Blackberries prefer soils and locations near banks of rivers or along the edges of woods wherever humus and moisture conditions of the soil favor their development. In planting a commercial blackberry patch similar conditions should be provided as near as possible. The turning under of leguminous crops, frequent cultivation and application of barn yard manure or a complete commercial fertilizer on moisture retaining soil would assure these requirements.

MAC DONALD BLACKBERRY

The MacDonald Blackberry is recommended for the southwest section of the United States; it is being grown commercially on a large scale in Texas. This variety was therefore selected for testing at this station under the following conditions:

1. **Soil.**—A clay loam subsoil was selected that could be well drained. Biloxi soybeans were planted and turned under in the fall. After flat breaking the land, barn yard manure was applied at the rate of 10 tons per acre, supplemented by 200 pounds of superphosphate.

2. **Planting.**—The rows which were made up in February were five feet apart and on these the plants were put out. Three rows of MacDonald blackberry were interplanted with one row of Lucretia dewberry for pollination. The MacDonald blackberry is an imperfect flowered variety and therefore requires a perfect flowered variety for the setting of fruit. The plants were set three feet apart requiring 2904 plants per acre.

3. **Fertilizers and Cultivation.**—The plants were kept clean and in April soybeans were planted between the rows. In May when the plants had established themselves an application of nitrogen fertilizer was applied as a top dressing. The amount of cultivation depended upon the season, but the grass was kept out and Biloxi soybeans were turned under for humus in the fall. In the following spring the plants were cultivated by plowing the soil toward the plants and an application of complete fertilizer was given. This was done each spring thereafter.

The first season the plants bore at the rate of 50 crates per acre (24 pints).

4. **Harvesting and Marketing.**—The third growing season and for a period of three years thereafter the average yield was 150 crates per acre, the low yield being due to dry weather and adverse weather conditions. The fruit was picked and graded in the field, care being taken not to put in over ripe or undersize fruit. This eliminated the expense of sorting and packing of the berries later as is done with the strawberries. The picking was done in the morning and shipment made along with strawberries in refrigerator cars.

The report received from Chicago and Detroit markets was that they arrived in good condition though there was a very small demand for blackberries at that time. The local market was very poor and it was often impossible to sell the fruit. The season of picking lasted two or three weeks depending on the weather conditions, dry weather causing small fruit and a short season while a wet season improved and prolonged the picking season but interfered with the pollination during the blooming time and consequently reduced yields.

5. **Pruning.**—Each season after the fruit was picked the old canes were cut out and four new fruiting canes were allowed to grow. When the season was wet they made a vigorous growth and required cutting back again to a height of three feet during the summer. Further cultivation and care were given as in the previous season.

LUCRETIA DEWBERRY

The Lucretia dewberry was handled in the same way as the MacDonald blackberry. It, however, was allowed to trail on the ground; blackberries naturally making an upright growth. The dewberry is usually trained on stakes or wires but for our purpose the berries were allowed to trail on the ground to save expense. The fruit was larger than the blackberry and ripened about one week later but was not as prolific as the blackberry.

RENEWING THE PATCH

After five years the patch became infested with a disease known as "witches brooms". Another site was selected and reset in the new patch. These plants came from vigorous suckers formed at the base of the mother plants.

While the blackberry has not proven very profitable, it is possible that if it were grown cooperatively, it could be made to be a money crop supplementing the strawberry crop of Louisiana.

MUSCADINE GRAPE CULTURE

The muscadine grape is native to Louisiana, growing wild along streams on a variety of soil types but prefers light sandy loams with clay subsoil. It belongs to the Rotundifolia species of American grapes and differs from the bunch grapes in that it forms small clusters of fruit containing 4 to 8 berries that shed off easily.

THOMAS VARIETY

The Thomas variety was selected for testing because of its fine quality. The flesh of this variety was found to be tender and juicy, the skin thin and of a dark red color, ripening about the middle of August and continuing until about the middle of September. The growth was vigorous and the vines were free from injury by insects or diseases.

1. **Soil.**—The muscadine grape does not thrive on heavy clay soils but prefers well drained sandy loam with clay subsoil under which conditions it grows naturally. For this reason care was taken to select the foregoing type of soil. Organic matter was added to the soil by growing leguminous crops during the summer and by plowing this mass under in the fall. The land had been in cultivation previously and was in a loose friable condition to receive the young plants.

2. **Planting.**—One year vines, well rooted and pruned for planting, were received from a nursery. Ridges were plowed up fifteen feet apart and the young plants set out ten feet apart in the row. The plants were set deeper than they grew in the nursery, care being taken not to kink or bend the roots, leaving a slight depression in the nature of a water basin. Loose soil was placed around each vine to form a mulch after the dirt had been pressed tightly around the roots. The roots were never allowed to dry out. Early spring was the time of planting. Soon after the plants began to grow, an application of commercial fertilizer was made near the plants. This consisted of 200 pounds of superphosphate and 100 pounds of nitrate of soda per acre. The young vines were carefully cultivated during the early season and a cover

crop of cow peas planted broadcast in June. In planting the Thomas variety one male vine was interplanted to each ten vines of the variety plants. It was found that the plants near the male vines set fruit more abundantly due to pollination. It is therefore recommended that more male vines be interplanted increasing the number to one per eight vines of the variety planted. It has been observed that both wild and domestic bees are active on the blooms of the grape vines and are responsible for this pollination and the setting of fruit.

CULTIVATION AND FERTILIZATION

After each season of growth of the grape vines each spring the soil was plowed away from the vines after being fertilized with superphosphate and nitrate of soda, and the weeds near the vines were hoed out. Later in the season in May or June the soil was again plowed and worked toward the plants. Cowpeas were broadcast at this time in the vinyard and harrowed in on the plowed ground. Where the grape vines were spaced farther than 15 feet apart, watermelons and cantaloupes were grown as an intercrop.

The main idea followed in the cultivation was to give deep plowing in the spring to send the roots down into the ground so that the vines could withstand the dry season. The vines never suffered from drouth where they were so treated. Where vines received no cultivation and no cover crops, but were merely hoed to keep out weeds, there were some that died out and others became defoliated during the summer causing the fruit to dry up and drop off. After the third season of growth the amount of fertilizer was increased to 600 pounds of superphosphate and 200 pounds of nitrate of soda per acre.

PRUNING AND TRAINING

Pitch pine posts nine feet long and six inches in diameter were set two feet deep between each vine. The posts were braced at the ends of the rows. Number 10 wire was used to form a trellis. The two wire and three wire horizontal arm system was used in training the grape vines and in the six years of growth it was found that the two wire system was more satisfactory than the three wire system. In the two wire system the lower wire was placed 40 inches from the ground and the upper wire 36 inches above the lower, while in the three wire system the spacing was 24 inches apart.

The best time for pruning the muscadine vines was found to be in December and January. Vines pruned in February and March had a tendency to bleed. When the one year old plants were set out they were already pruned in the nursery otherwise they would have to be pruned to one short spur of 3 or 4 buds. During the first season of growth only one stem was allowed to grow, all other growth was cut out during the growing season. On this main stem which reached the top wire at the end of the first season's growth, lateral branches were allowed to form at each wire only, all other growth was cut out during the growing season. This pruning and training is important as it is in the first two years of the growth of the vines that this can be best done. At the end of the first year's growth of the vines the lateral branches were pruned back to short spurs of 3 to 4 buds.

During the second season the vines made a growth from each spur left the previous winter and it was necessary to go over the vines in July and cut out all growth except that coming from the spurs left to form the horizontal fruiting arms, six fruiting arms on the three wire trellis and four on the two wires. By the end of the second season the lateral arms were fully developed reaching to the adjacent vines, and had a lateral growth of young shoots 2 to 3 feet long. During the winter this growth was cut back to short spurs and some to long spurs. Each winter thereafter the previous season's growth was pruned back to spurs on which the fruit was borne. The short spur method was found to be more desirable. Further pruning consisted in cutting out old wood and suckers that formed at the base of the vines or on the main stem.

Where the growth of the old arm was reduced in vigor it was cut and a new fruiting arm allowed to take its place.

PICKING AND MARKETING

The Thomas variety produced about one pound of fruit per vine the third year after planting. The fourth year of growth they averaged 3 pounds per vine, fifth year 4 pounds per vine, sixth year 6 pounds and seventh year 10 pounds per vine. Individual grape vines grown under garden conditions have produced an average of 40 pounds of hand picked fruit on seven year old vines. The foregoing low yields are given from the vines grown under field conditions from 551 Thomas plants.

Grape vines planted 10 ft. apart in rows 10 ft. apart would require 435 vines per acre. At seven years of age under field conditions on light sandy soils an average of 4350 pounds of grapes at 4 cents per pound would bring a return of about $175.00.

The fruit was picked by hand as soon as it began to ripen which was about the middle of August and placed into the hampers which would hold 50 pounds of grapes. The ripening of fruit continued for a period of three to four weeks. During a dry season the crop was short, the season lasting only 15 to 20 days, while during a normal season the condition of the fruit was better and the season longer.

The clusters would not all ripen at the same time but each berry of the first set crop of blooms would ripen first and if not picked would drop off. All fruit was sold locally, none being shipped as there was little demand for it. The surplus was made into unfermented grape juice according to the formula of U. S. Farmers bulletin No. 1075 and 1454. The grape juice was of a light yellow color and a delicious flavor, but there was no market for it even at $2.00 per gallon.

VARIETIES

The Thomas variety proved to be of best quality for eating and for the manufacturing of grape juice. The fruit is dark red in color, medium size, thin skin and soft pulp. When pressed fresh it makes a golden yellow juice. It is excellent for making jellies, jams, preserves and pastes in accordance with U. S. Farmers Bulletin No. 1454.

Memory is another variety that produced fruit of excellent quality with dark blue berries, vigorous vines but is not so prolific as the Thomas.

Luola is similar to the Memory variety.

The Scuppernong was found to be next to Thomas in quality. The vine is vigorous and healthy producing fruit a little larger than Thomas. The color of the fruit is bronze-greenish containing russet blotches. The flesh is soft and juicy, sweet and of very good quality. This variety has not yielded as well as the Thomas.

Kilgore was originated at Willard North Carolina by Charles Dearing. It proved to be of excellent quality, producing abundantly of a light green colored fruit, sweet and juicy with very little pulp.

The James and Flowers variety were excellent for jelly making, prolific but not very good flavor. Fruit is dark blue to black in compact clusters and ripens later than the Thomas.

Other varieties were tested but found undesirable for home or commercial use.

PROPAGATION

All varieties of muscadine grapes were found to be difficult to grow from cuttings. The Thomas variety was more easily propagated than the Scuppernong variety. Cuttings 12 inches long were made during the winter from previous seasons growth and planted 10 inches deep in well-prepared garden soil, care being taken to insert the cutting slant wise so that the lower end of the cutting would not extend into the clay subsoil. The soil was well firmed and later cultivated to keep out weeds and to conserve moisture. During dry weather it was found necessary to irrigate them especially when they started to grow in the spring.

Layering is the best method of propagating muscadine grapes. This consists of covering the current season's growth in July. The rooted stems are dug up during the winter or spring and set out wherever desired. They do not make as vigorous plants as those propagated from cuttings. In case the soil or climatic conditions are not favorable for transplanting, the newly rooted plants can be heeled in and kept until Spring at which time they may be transplanted. The best way to establish a Muscadine vinyard is to obtain plants one year old from a reliable nurseryman.

AUGUST, 1930 LOUISIANA BULLETIN No. 214

DAMAGE BY THE RICE WATER WEEVIL PROVED NEGLIGIBLE

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(1) Special acknowledgment is made to J. Mitchell Jenkins, Superintendent of the Rice Experiment Station, Crowley, La., for valuable cooperation and assistance. Acknowledgment is also made to C. E. Chambliss, in charge of Rice Investigations, Bureau of Plant Industry, and to T. E. Holloway, in charge of Sugar Cane and Rice Insect Investigations, Bureau of Entomology, for their interest and suggestions.

It will be noticed that this work was done by two employees of the United States Department of Agriculture, at the Rice Experiment Station, Crowley, La. All of the work done at this Station is cooperative, the United States Department of Agriculture bears a part of the expense and the Louisiana Experiment Station a part.

DAMAGE BY THE RICE WATER WEEVIL PROVED NEGLIBIBLE

The rice water weevil (2) is present in practically all rice fields in the South. The larva of this weevil feeds upon the roots of the rice plant and the adult feeds upon the leaves. As soon as the rice is flooded, the female weevil lays eggs in the roots of the rice plant, from which the larva, or "root maggot," develops. There are at least two generations a year. The water weevil goes through its life cycle on a number of grasses growing in water as well as upon rice. Drainage of the flooded fields to control the weevil has been the practice when the rice looked sickly or yellow. The work of drainage is troublesome and expensive, however, as it involves the cutting of the levees and their subsequent reclosing, and causes a considerable waste of water in reflooding. The planter who pumps from his own well is put to extra labor and expense, while the canal companies that furnish water to other planters must spend more money for pumping. In dry years in Louisiana, when much of the fresh water is pumped from the streams, salt water may sooner enter from the Gulf, and thus an excessive percentage of salt may be present in the irrigation water, which is injurious to the rice.

Great trouble and expense would be justified in the control of a serious pest, but as far back as 1922 there was a suspicion in the minds of a few rice planters that the water weevil could not be so classed. After eleven years of observation, Mr. J. Mitchell Jenkins, Superintendent of the Rice Experiment Station, Crowley, La., concluded that the damage caused by the "root maggot" is very small.

Observations made in 1923 showed that the so-called "root maggot" injury was often caused by soil conditions, deep water, grass, and other things unfavorable to rice culture.

It was therefore decided that before further control work was done on the rice water weevil, experiments should be made to determine the amount of injury caused by its feeding. Accordingly in the spring of 1924 a screened cage was constructed, 17 feet wide, 39 feet long, and 6 feet in height above the rice levee. This cage, as well as the later ones, was covered with 18-mesh screen wire which was known to prevent the entrance or escape of water weevils. There was a screen-wire partition in the center, dividing the cage into two equal parts. In the spring of 1926 three additional cages were constructed. These were 18 feet wide, 40 feet long, and 6 feet in height above the rice levee. Except in size, they were exact replicas of the first cage.

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(2) Lissorhoptrus simplex Say.

The land on which the cages were placed was typical rice land. It was prepared and the rice planted in drill rows 8 inches apart, as is the most common local field practice. The Fortuna variety of rice was used in 1924 and 1925, and the Blue Rose in the years following. A margin was allowed on all sides of the cages. The actual planted area in each side within the first cage was 16 by 14 feet, or 224 square feet. The area planted in each side within the last three cages was 18 by 16 feet, or 288 square feet. The irrigation water was run into the cages through pipes having their openings covered with fine screen to prevent the entrance of water weevils. Just before or immediately after flooding, all weevils which could be found were collected from both sides of the cages. Weevils were then released in one side of each of the cages, while the other side was kept free from them. The side in which weevils were released was alternated each year. The number released annually was 450 in the first cage and 612 in each of the other cages. These numbers were selected as representing the largest number of water weevils found in the rice under actual field conditions. (1) The weevils for the cages were caught from rice fields prior to flooding, or at the time of flooding.

Plant heights were recorded about three weeks after flooding and at intervals thereafter. The height of 10 plants growing in each side of each house was taken. Throughout the season an attempt was made to approximate as nearly as possible the actual field conditions in the cages. The water in them was drained prior to harvesting and the rice cut and shocked inside the cages. Later, the rice was threshed and the grain and straw produced in each side of each cage were weighed.

(1) In determining the number of weevils to release, counts were made in flooded rice fields by means of a screen frame 2 by 2 by 2 feet. The frame was set down in a rice field and counts made of the weevils inside. About ten minutes was taken for each count to allow weevils beneath the surface to come to the surface. A count was made in five places in each field and the result of the five counts averaged. The largest number of weevils found in a rice field was 8 per 4 square feet.

The weight of the grain produced in the cages was as follows:

Cage No.	1924		1926		1927		1928		1929	
	Inf.	Un-Inf.	Inf.	Un-Inf.	Inf.	Un-Inf.	Inf.	Un-Inf.	Inf.	Un-Inf.
	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
1	10.37	9.62	4.87	3.87	----------	----------	----------	----------	----------	----------
2	----------	----------	13.50	11.50	10.13	8.75	7.40	7.50	10.50	11.5
3	----------	----------	7.00	8.37	14.25	13.25	5.10	6.20	13.75	11.0
4	----------	----------	6.75	7.75	----------	----------	8.10	7.80	7.00	7.5

The total weight of the grain produced in the infested sides of all cages was 118.72 pounds, while the total weight in the uninfested sides was 114.61 pounds. From these figures it appears that the insect has no appreciable effect on the yield of grain.

The weight of the straw produced in the cages was as follows:

Cage No.	1924		1925		1927		1928		1929	
	Inf.	Un-Inf.	Inf.	Un-Inf.	Inf.	Un-Inf.	Inf.	Un-Inf.	Inf.	Un-Inf.
	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
1	32.0	33.8	13.6	13.8	----------	----------	----------	----------	----------	----------
2	----------	----------	----------	----------	18.2	18.0	13.6	14.8	15.0	15.75
3	----------	----------	----------	----------	31.2	28.2	26.8	27.2	21.5	24.00
4	----------	----------	----------	----------	----------	----------	19.2	17.2	15.0	16.25

The total weight of the straw in the infested side of the cages was 206.1 pounds, while the total weight of that from the uninfested sides was 209 pounds. Thus it is evident that the weevil has little effect on the straw. It might be mentioned here that a heavy yield of straw is not desired by the rice planters.

In 1926, heavy rains followed threshing and the straw began to rot before it was dry enough to be weighed; therefore, no weights for the straw were obtained. In 1925, rats destroyed a part of the grain in the shock on the uninfested side, consequently when weighed it was several pounds less than in the infested side and these figures were not placed in the grainweight tables.

To determine whether lighter grains resulted from the feeding of the root maggot, 5 lots of 100 grains each from each side of the cages were husked and weighed. The average weight for 100 grains from the infested side was 2.146 grams, and for 100 grains from the uninfested side, 2.150 grams. Two other lots of 500 grains each were weighed and gave, infested side, 10.67 grams, and uninfested, 10.68 grams. It thus appears that the presence of the water weevil does not cause lighter grains.

It was found that the rice plants in the infested side were generally smaller in height when examined three or four weeks after flooding.

During the years while the screen-cage experiment was running, field observations were made to supplement the experimental data. It was found that, as a general rule, all rice takes on a sickly, yellowish color about three weeks or a month after flooding. This color is evidently due to the fact that the rice plant sheds one set of roots and puts out a new set. At this time the rice is said by the planters to be suffering from "root-maggot" injury. Sometimes the rice leaves develop a reddish tinge and many die. Fields have been examined in which all but the top leaves were dead. Upon examination, it was usually found that few rice water weevils were present, while a larger number were present in the roots of healthy plants nearby. Many times this condition was found to be due to the fact that the water was so deep that only the topmost leaves were above the surface. In other cases it was apparent that soil conditions were the cause of the poor appearance of the rice. In some fields, grass was so thick that the rice had a stunted, sickly appearance.

The cage experiments do not indicate that the water weevil produces an appreciable effect on the yield of grain or straw. From the results of the cage experiments and also from extensive observations, it may be stated that the loss to the rice crop from "root-maggot" injury is negligible, and that drainage undertaken for the purpose of killing "rootmaggots" is never worth while. Drainage may, however, be necessary and worth while in order to cure other ills heretofore said to have been caused by the "root-maggot."

Mayer

NOVEMBER, 1930 LOUISIANA BULLETIN No. 215

An Economic Study of Factors Affecting Farm Organization and Power Utilization of Sugar Cane Farms, 1929

By

G. H. REUSS

LOUISIANA STATE UNIVERSITY
AND
AGRICULTURAL AND MECHANICAL COLLEGE
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AGRICULTURAL EXPERIMENT STATIONS
C. T. DOWELL, Director

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By G. H. REUSS

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AN ECONOMIC STUDY OF FACTORS AFFECTING FARM ORGANIZATION AND POWER UTILIZATION OF SUGAR CANE FARMS, 1929

By G. H. REUSS,
Assistant Economist

THE re-building of the sugar cane industry in Louisiana raises many problems to be solved by the individual farmer. This study was undertaken in order to help farmers meet these adjustments. Two major problems, (1) the enterprise organization of the farm, and (2) the possibility of improved adjustments in the use of a greater amount of power machinery than prevails at the present time, are discussed in this report.

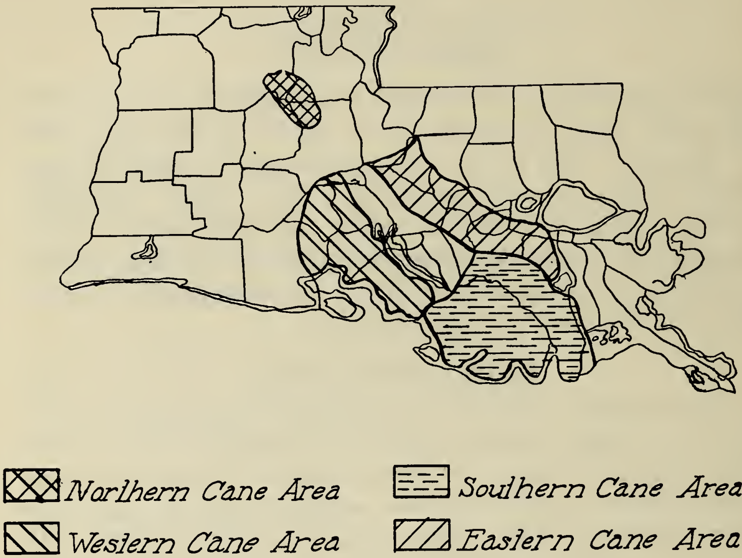
FARM ORGANIZATION

The fact that cane has been successfully grown in the area for so long a period proves its adaptability to Louisiana soils and climate. Although large losses sometimes occur because of early freezes and from floods and high water, these are rare. The region is well supplied with a class of labor adapted to the growing of cane. These facts, together with the fact that cane yields a relatively high return per acre, assure its continued growth in the area. Over a period of years no other crop has proven to be so remunerative as cane. Therefore the immediate future development in crop organization will include sugar cane as the primary crop.

A number of crops grown in the cane belt offer possibilities as minor or secondary crops in the organization of sugar cane farms. These crops include corn, soybeans or peas, cotton, rice, sweet potatoes, white potatoes and a variety of truck crops. The sections of the cane area in which these crops are now grown to some extent and to which they seem to be best adapted are shown in Figure 1.

The writer wishes to acknowledge that a part of the data presented in this report was collected in cooperation with the United States Department of Agriculture, and to express his appreciation to Professor R. J. Saville for his helpful suggestions throughout the development of the study and for assistance in the preparation of this manuscript.

Fig NO. 1-Louisiana Sugar District by Secondary Crop Areas



NORTHERN SUGAR CANE AREA

Secondary crops in this area are cotton, corn, soybeans, peas, and sweet potatoes.

WESTERN CANE AREA

A variety of crops are grown with success in this western region. Cotton, corn, and legumes are successfully raised throughout the area. Rice is grown to some extent throughout the region, but more particularly in Vermilion Parish. Peppers, sweet potatoes, irish potatoes and other truck crops may be successfully raised in practically all parts of the region.

SOUTHERN CANE AREA

This area is practically limited to corn and truck crops as supplementary crops for cane. Among the truck crops beans and irish potatoes are the ones most commonly raised at the present time. Yields of secondary crops are much higher than in the other areas.

EASTERN CANE AREA

Crops other than cane grown in this area are corn, and legumes, with smaller amounts of rice and truck.

The kind and acreage of crops which each farmer should grow will be determined by relative prices of products which he grows and by the outlays which will be necessary in order to carry on his productive activities. In considering prices the farmer must keep in mind present relationships and probable future trends. In developing the proper organization to be maintained for a number of years, however, price trends and the level of the prices for each product as compared with that for others which compete with it for a place in the organization are more important than short time fluctuations. Annual changes in organization to meet changing prices may often be profitable providing they are carefully made. Farmers must use the best available information indicating expected prices for the next year as a basis in deciding on contemplated changes. Undue influence should not be given to past or present prices.

It is impossible to predict year-to-year variations in yield per acre because these are due almost entirely to seasonal conditions. The important question to the individual farmer, however, is the comparative yields of the various crops which he may expect to receive on his particular farm under normal conditions. While cane yields for the new varieties are still under experimental observation, they have definitely proven to be larger than those obtained from the old canes. Probably an average of as much as twenty-five tons per acre is to be expected over a period of years. Yields obtained in the past on the particular farms or those of similar farms, after making necessary allowances for differences in cultural practices, will serve as a basis for the expected production of each crop.

There are certain relationships between crops which must be taken into consideration in order to have the farm organization operate smoothly after it is set up. These may be classed as competitive, supplementary, and complementary relationships. Theoretically, crops may compete for land, for the use of capital, and for labor. For crop organization, we are interested in choosing crops in such proportions that competition for man labor, use of machinery, and other factors be reduced to a minimum. It is desirable to get enterprises that fit together or supplement each other in the most profitable utilization of the elements of production. It is especially important on the family-sized farm that the labor distribution be such that the available family labor may be fully occupied on productive enterprises throughout the year. The number of mules kept must necessarily be large enough to meet the demands in the season of highest mule work requirement. An even distribution of mule labor will mean that fewer mules need to be kept but that these will work more days per year. The labor distribution is equally as important on the large plantation as on the small farm. If conditions are such that laborers must be maintained on the plantation throughout the year and given employment for a major portion of the time, it is essential that they be working at a profitable enterprise. If, on the other hand, labor may be commanded and dismissed at short notice an even distribution will not necessarily reduce the cash wage bill. Sugar cane production normally demands the latter condition. The cost of housing and other perquisites, however, would be decreased because of the fewer men required.

In determining the sequence in which crops are to follow each other, the tilth of the land and the available plant food after each crop is removed will affect the growing of the crop which follows. If a favorable relationship exists between two crops they are said to complement each other.

Crops may also be competitive or complementary as to use of machinery. A crop requiring a large outlay for specialized machinery and equipment cannot be produced economically unless a large enough acreage is planted to efficiently use this machinery, and unless the crop is grown for several years in order to completely use the investment. Crops which may be grown by using, for the most part, machinery which was purchased primarily for the culture of the major crop, cane, have a marked advantage in this respect.

The efficiency of operation of the farm will depend somewhat on getting the right combination of the units of production. In many respects the plantation or large sized unit has the advantage over the medium sized farm. Crews of sufficient size to warrant an overseer for each group may be more closely supervised than is the case where one man must overseer a number of operations being performed at widely separated places. The apportioning of task work is facilitated by keeping a crew at the same job for a considerable period of time, which is often impossible on a small farm without breaking the labor into small groups, thus making supervision difficult.

In order to determine more specifically the extent to which the above factors influence the organization and operation of Louisiana sugar farms, information in some detail on a number of farms in actual operation was secured. Part of this information was obtained by means of a survey[1] made in February 1930 by the Department of Rural Economics of the Louisiana State Experiment Station in cooperation with the United States Department of Agriculture. Seventy-four farms growing cane for the mill were included. These farms are scattered throughout the greater part of the cane producing area of the state, being located in Lafayette, Iberia, St. Martin, St. Mary, Terrebonne, Lafourche, Ascension, and Assumption Parishes.

Additional data were collected from fifteen large plantations concerning their costs and organization during the year. Price data were obtained from the United States Department of Agriculture yearbooks, from Crops and Market, and from reports of the Louisiana division of the Bureau of Crop and Livestock Estimates.

During the cane harvesting season of 1929, sugar growers suffered extremely unfavorable weather conditions.

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[1] The survey method consists of a visit to each farm operator to obtain the desired information from his business and personal records, and from memory. By checking this method against actual accounts it has been found to be quite accurate when applied to a number of farms.

These so delayed harvesting that a large proportion of the crop was uncut at the time of the first hard freeze. This condition resulted in large losses from cane left in the field uncut, losses in the windrow after cutting, losses from low topping due to frost, and from low prices resulting from the deterioration of mill cane. Heavy rains added to the difficulty of harvesting so that labor and power requirements were increased much above those of a nearly normal year (Chart 1). Due to these unusual conditions in 1929, data on income and on harvesting costs and operations are not to be considered as picturing a representative condition.

In most respects, however, these farms were organized and operated in a normal way prior to harvest. There is no evidence that unusual conditions affected the crop or livestock organization, cost of growing cane to harvest, costs or requirements of other crops, or use and cost of tractor and other power machinery at any time before the cane harvesting season.

For purposes of analysis the survey records were divided into four groups according to the number of acres of principal cultivated crops as follows:[2]

	No. of Farms	Size Range	Average Crop Acres per Farm
Group A	18	Less than 100 Acres	86.59 Acres
Group B	21	100 to 199.9 Acres	155.00 Acres
Group C	18	200 to 299.9 Acres	246.76 Acres
Group D	17	300 or more Acres	650.23 Acres

Group A may be considered as the family-sized farm on which members of the family perform the major part of the labor and in many cases all of it except during the harvesting season. The other extreme is found in Group D which is the plantation type of organization. Under the latter organization all the labor is hired and a major portion of the managerial duties is performed by hired overseers. Group B and C are intermediate in the above respects. The classification will be carried throughout the analysis.

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[2] Principal cultivated crops are cane, corn, cotton, soybeans, or cowpeas, alfalfa, rice, and seeded hay crops.

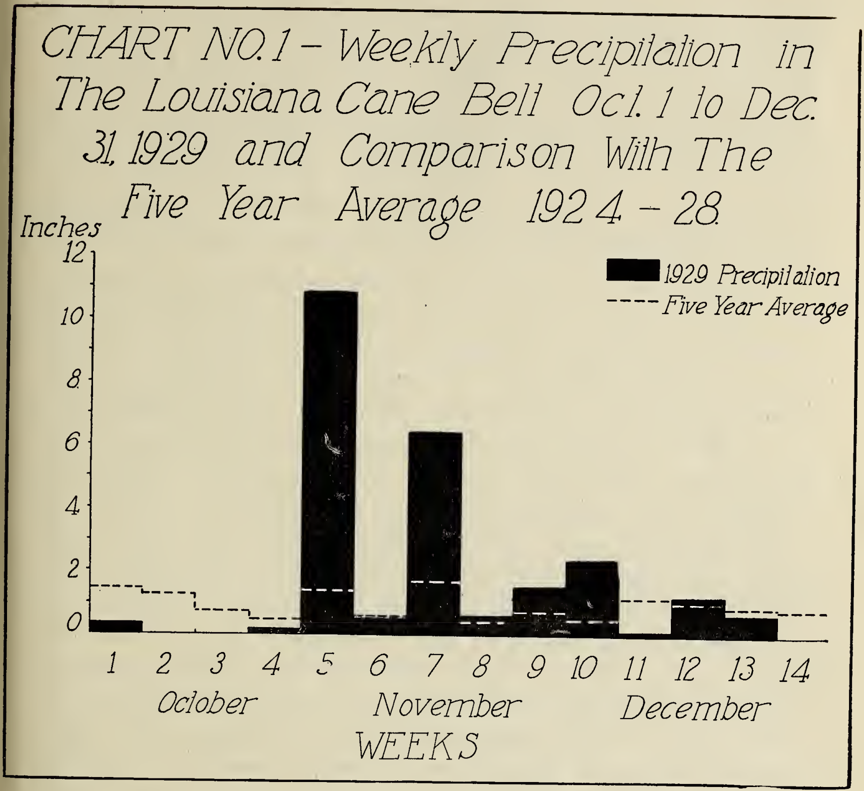


CHART NO. 1—Weekly Precipitation in The Louisiana Cane Belt Oct. 1 to Dec. 31, 1929 and Comparison With The Five Year Average 1924–28

ECONOMIC STATUS

Throughout the latter part of the nineteenth century the United States produced not only her own food stuffs, but also exported large excesses, principally to European countries. The middle west was supplied with rich virgin land which could be had by homesteading or for a very low price. The homesteading of this land and the consequent swelling of the physical volume of production increased rapidly up until the end of the century in spite of the low prices which prevailed at the time. The beginning of the century, however, brought a reverse in the trend. The good lands were for the most part in cultivation, thus checking the increase in production, and urban population was growing rapidly with an ever increasing demand for food. Exports decreased markedly in the years immediately preceding the World War and were practically in balance with imports. This pre-war period was one in which both agriculture and industry were relatively prosperous and so may be considered as a time during which a satisfactory relationship existed between the prices of farm products and the prices of non-agricultural products.

During the period 1914 to 1920, agricultural production was abnormally stimulated by high prices. This artificial stimulation brought physical production quickly to a high level in 1920 at the time of the post war deflation. Since 1920 agricultural prices have been at a relative disadvantage. When compared with pre-war levels, the prices which the farmer must pay for his living and for production expenses are considerably higher than those which he receives for his products (Chart 2). Some allowance may surely be made for economies in operation. The price level of those products which he buys is also above that for all non-agricultural products, due principally to the relatively high level of living costs. Although the spread between prices received and prices paid narrowed somewhat in the latter part of 1927, there has been no tendency since that time for them to become more nearly equalized. In fact the price disadvantage has become more aggravated during the early months of 1930. Expressed in another way, this means that the value of the farmer's dollar in terms of products which he purchases has declined. Although it rose to ninety-four cents at one time during 1928, it was only eighty-one cents in June 1930. The disparity is the difference between eighty-one cents for products purchased by farmers compared with eighty-eight cents for all non-agricultural products.

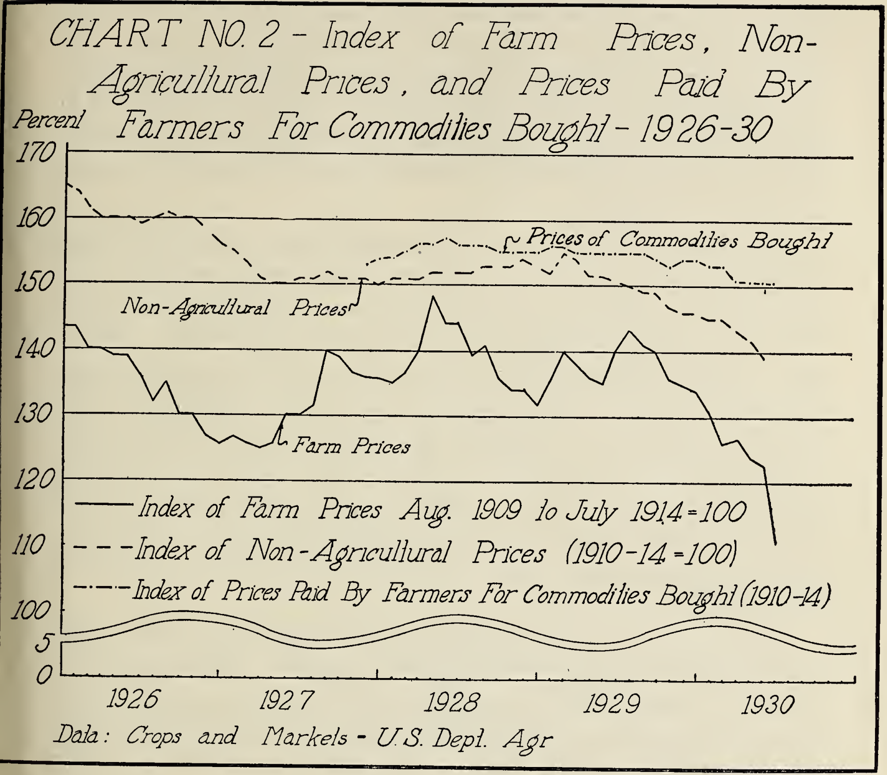


CHART NO. 2 - Index of Farm Prices, Non-Agricultural Prices, and Prices Paid By Farmers For Commodities Bought - 1926-30

Data: Crops and Markets - U.S. Dept. Agr

DEVELOPMENT AND PRICE STATUS OF THE LOUISIANA SUGAR CANE INDUSTRY

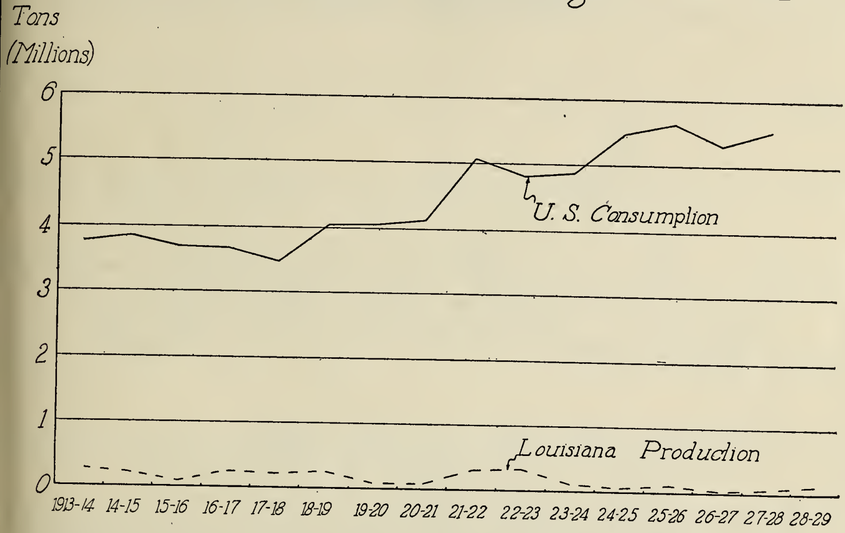
Cane for the production of sugar has been the staple crop of South Louisiana since the beginning of the nineteenth century. In spite of temporary financial depressions, the industry grew steadily up until about 1904 and remained nearly constant from that time until the end of the World War. Technical developments and long time economic changes within the country are reflected in this growth of the Louisiana sugar industry. In more recent years diseases and pests of cane became such a menace that they threatened to exterminate the industry. From an average yield of sixteen or seventeen tons per acre the yield was cut to as low as seven tons per acre in 1926, principally because of the spread of the mosaic disease. A rapid drop in acreage also occurred, 73,000 acres in 1927 as compared with more than 220,000 for the period 1911-23. Although part of this acreage was diverted into other crops a large portion was abandoned and allowed to grow in weeds and brush.

The introduction of P. O. J. canes has practically eliminated the losses suffered because of the mosaic disease and has proven conclusively that Louisiana can produce as large or even a larger tonnage per acre than in the past. Due to this varietal development large acres are at present being brought back into cane culture, under new methods. The world production of 26,800,000 tons of sugar in 1929 as compared with 15,500,000 tons in 1919, represents steady increase for the period. Sugar prices fell rapidly along with other food products during 1921, recovered slightly in 1923 and 1924, and since that time have shown a gradual decrease.

The price of sugar the last few years has been only slightly above that of the pre-war period. This decline in price has come about at a time when Louisiana production, due to mosaic disease and other unfavorable conditions, has been low, thereby placing Louisiana producers at a disadvantage both in price and in respect to yields. The Louisiana production of sugar is only a small part of the total supply available for consumption in the United States (Chart 3). As a consequence the Louisiana supply does not have a significant price determining influence in the United States. Production in competing countries, particularly Cuba, the Philippine Islands, Hawaii, and Continental Europe and the height of the tariff seem to be the factors which will have the greatest influence on sugar prices received by Louisiana producers in the future.

The relative prices of other products grown to some extent in the sugar bowl are presented in Charts 4 to 6. These relations are expressed in terms of the base 1913 = 100. Cotton, sweet potatoes, and white potatoes

CHART NO 3 - United States Consumption and Louisiana Production of Sugar, 1913-1929



Louisiana Planter and Sugar Manufacturer, July 2, 1923
The Reference Book of The Sugar Industry of The World, July, 1929

have been relatively higher than corn, rice, and cane. Among the livestock products, veal prices have had a relative advantage over beef prices although both have been comparatively high in recent years and appear to be at the peak of a price cycle (Chart 7). If this is true, a downward trend may be expected in the prices of these products.

The prices received by the farmer are only one side of the farm business. The costs incident to the production of each crop and the efficiency of farm production with different combinations is an equally important side and one over which the individual farmer may exercise considerable control.

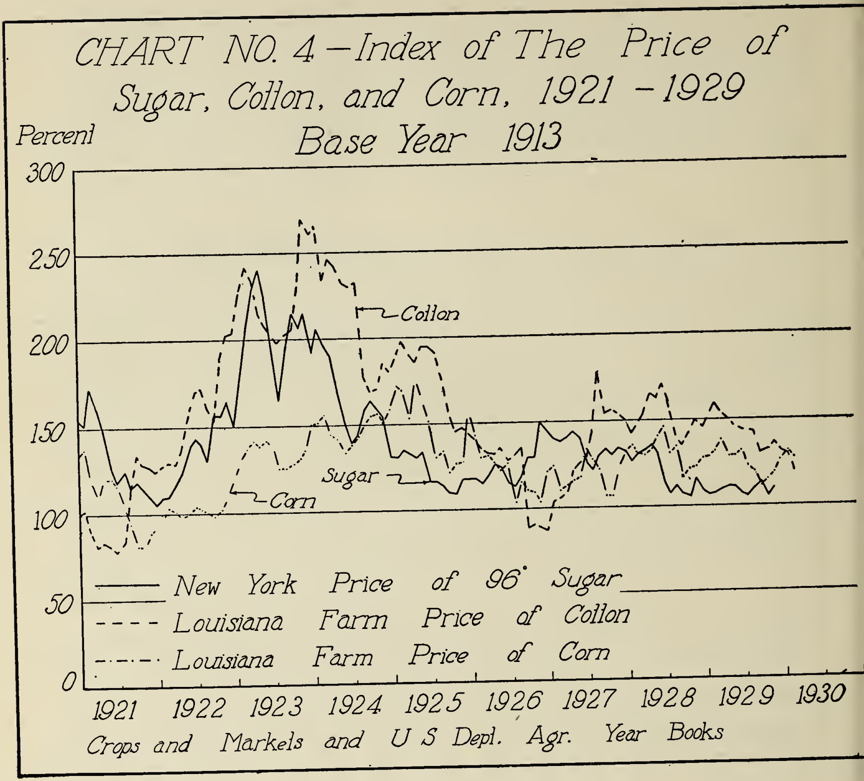


CHART NO. 4—Index of The Price of Sugar, Cotton, and Corn, 1921 -1929 Base Year 1913

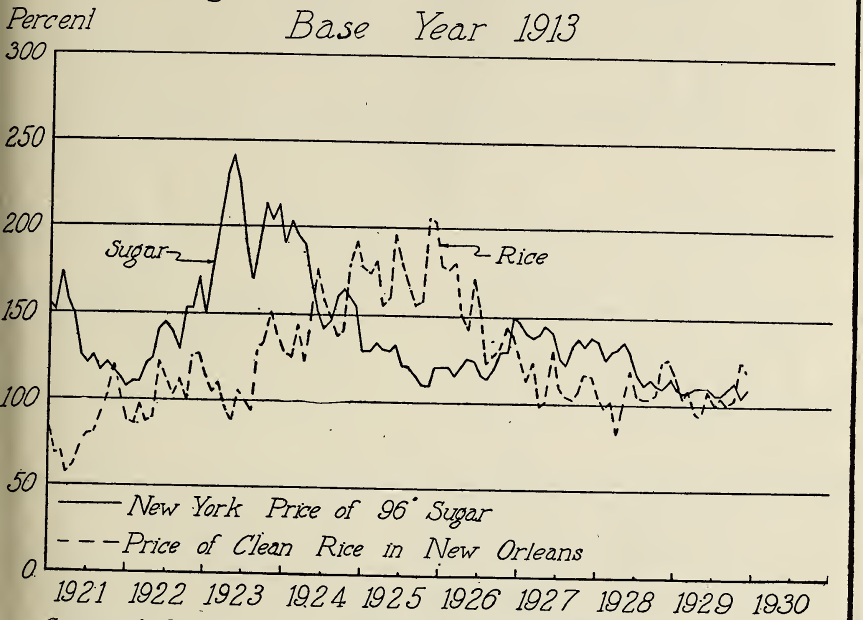
Crops and Markets and U S Dept. Agr. Year Books

UNIT REQUIREMENTS OF LABOR AND POWER

There is little difference in man labor and mule work requirements between size groups for any crop. It would seem that the type of soil, plantation layout and individual management are factors which cause variations in requirements between individual farms. Unit requirements of labor and power are presented in Tables 14 to 34 in the appendix.

It has been demonstrated that breaking the heavy or black lands of the cane belt requires double the power necessary to do an equally good job of plowing on light or

CHART NO. 5 - Index of The Price of Sugar and Rice 1921-1929 Base Year 1913



Crops and Markets and U. S. Dept. Agr. Year Books

sandy soils. After these heavy lands have been well plowed, however, their cultural requirements are little, if any, greater than those of lighter soils. If breaking is not well done, the heavy lands require an excessive amount of plowing during the cultivating season. By determining the power and labor requirements on fall plant cane on each of ten farms, one-half of which had a large proportion of heavy lands, the others being predominantly sandy, it was found that 11% more power was expended in land preparation on the heavy lands and that cultivation requirements were also 30% greater than on the second group of farms. Since current outlays are about the same, this difference in outlay should be reflected in lower land prices in such areas.

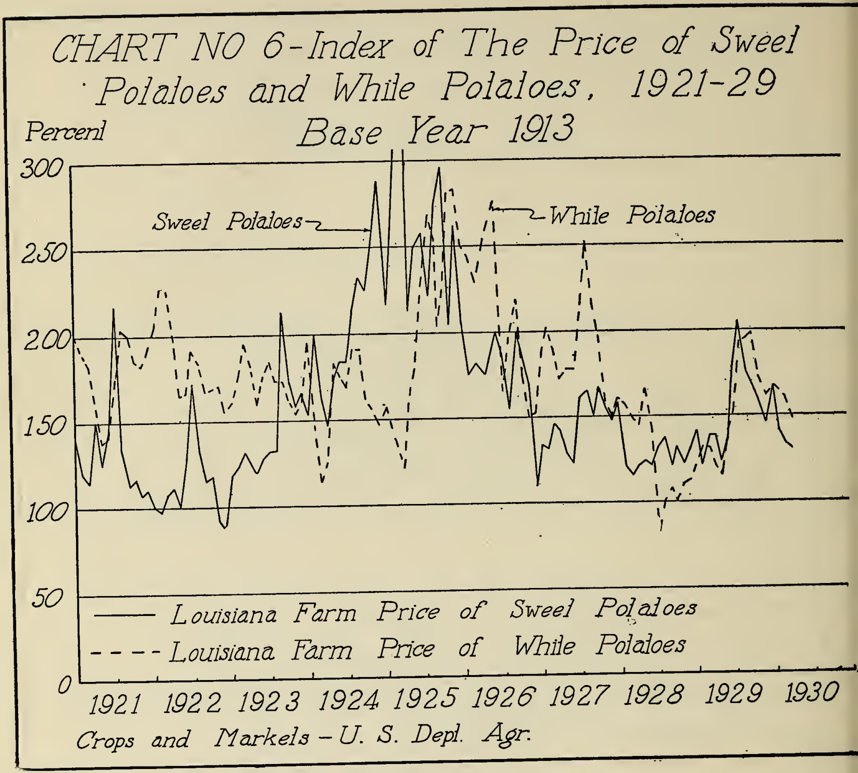


CHART NO 6-Index of The Price of Sweet Potatoes and White Potatoes, 1921-29 Base Year 1913

Crops and Markets – U. S. Dept. Agr.

The lay out of the plantation in reference to the stables, to the sugar house, and to loading points is a factor of more importance than is usually assigned to it. Especially is this true in seasons of heavy rainfall during harvest, as in 1929. The distance from the stable to each field when thought of in terms of hours spent going to and from work may materially influence the cost of tending that field. During harvesting this is even more important because every man and mule is being used to capacity. The distance between loading stations on the narrow gauge railroad is often so great that much additional hauling is required. There is need of a movable hoist on many plantations in order to decrease this haul. The economical use of such a hoist will depend upon the number of men and mules replaced

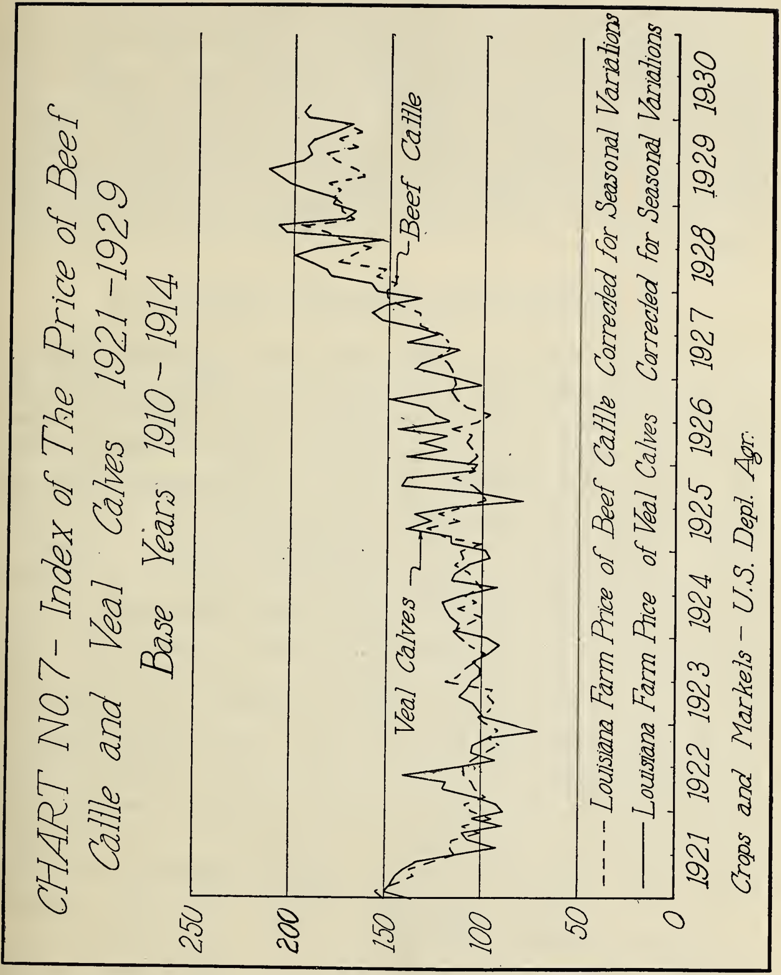


CHART NO. 7 - Index of The Price of Beef Cattle and Veal Calves 1921-1929
Base Years 1910-1914

Crops and Markets - U.S. Dept. Agr.

as compared with the costs incurred by its adoption. Any improvement in plantation roads will have the same effect as a decreased haul. Many plantations no doubt would be justified in making larger expenditures for roads than are now made in order to decrease power requirements in hauling during unfavorable weather and to eliminate roundabount hauls which occur when a part of the roads become impassable. The managerial ability of the individual operator also has its effect on cost.

Some operators are practically always up with their work while others are as regularly behind. This difference in managing ability will result not only in a variation in yields due to inferior tillage, on poorly managed farms, but also in increased cost due to the extra hoeing and extra cultivation which may be necessary if the opportune time for performing each operation passes without getting the work done.

MACHINERY AND EQUIPMENT UTILIZATION

The cash costs for machinery and equipment upkeep and repair amounted to $1.88 per acre on eleven plantations operating under a system of approximately 65% cane and 30% corn with a small amount of cotton. The interest charge was $.79 calculated at 8% on an average investment in machinery and equipment of $9.91 per acre. The investment in equipment on these plantations was not excessive nor was the cropping system such as to require specialized types of machines other than those commonly used in cane production. We may assume then that costs on these plantations are in line with those to be expected on cane and corn farms. With the exception of relatively inexpensive equipment, cotton has not materially increased the machinery requirement where it has been added in place of part of the cane or corn. Likewise sweet potatoes, white potatoes, and truck crops may be included in or withdrawn from the crop organization without disruption of the machinery balance. Equipment for rice growing presents a more complicated problem.

Rice, being an irrigated crop and grown under a flat culture method does not lend itself to the best use of equipment on a farm which is organized primarily for the growing of cane. The operations of flat breaking, building levees, and harvesting require specialized machinery for which row-crop equipment cannot be readily substituted. Irrigation perhaps offers even greater difficulties. For the purpose of irrigation the original outlay necessary is large and the life of the equipment comparatively long, thereby necessitating the growing of the crop over a number of years, and on such an acreage as to require capacity use in order to get operating efficiency. This factor is an important one in making rice growing a specialized industry even when carried on within the cane belt. But tractor farming is associated with rice farming and tractor utilization may be materially increased when both sugar cane and rice are grown.

LABOR AND POWER DISTRIBUTION

The system of growing cane and corn does not lend itself to the even distribution of either man labor or mule work. Charts 8 and 9 show the monthly requirements of labor and power on a 285-acre farm in Iberia Parish having 95 acres each of fall plant cane, stubble cane, and corn and soybeans. Two peaks are present in each distribution, one coming in February, March and April; the other, a large one, from October through December. This farm presents about the normal and expected labor distribution under successful sugar cane growing. Charts 10 and 11 show the distributions on a similarly organized farm where all the cane was spring planted. Spring planting of cane tends to shift a part of the labor requirement from the fall months to the late winter months. It would seem that a division of the cane planting between fall and spring tends toward the best man labor utilization possible under a system of cane and corn. The labor requirements for all work other than planting are of a relatively fixed nature with reference to time of performance.

The possibility of obtaining a more even distribution of man labor depends upon the development of harvesting machines which will decrease the fall peak, and upon efficient power machinery for spring work. It is very probable that the first development will greatly stimulate the latter. This will mean outlay for machinery rather than wages. If the cane industry is to continue as it is at present, it will necessarily do so in spite of poor labor and power distributions.

CHART NO. 8

Man Labor Distribution on a 285 Crop Acre Farm in Iberia Parish-1929

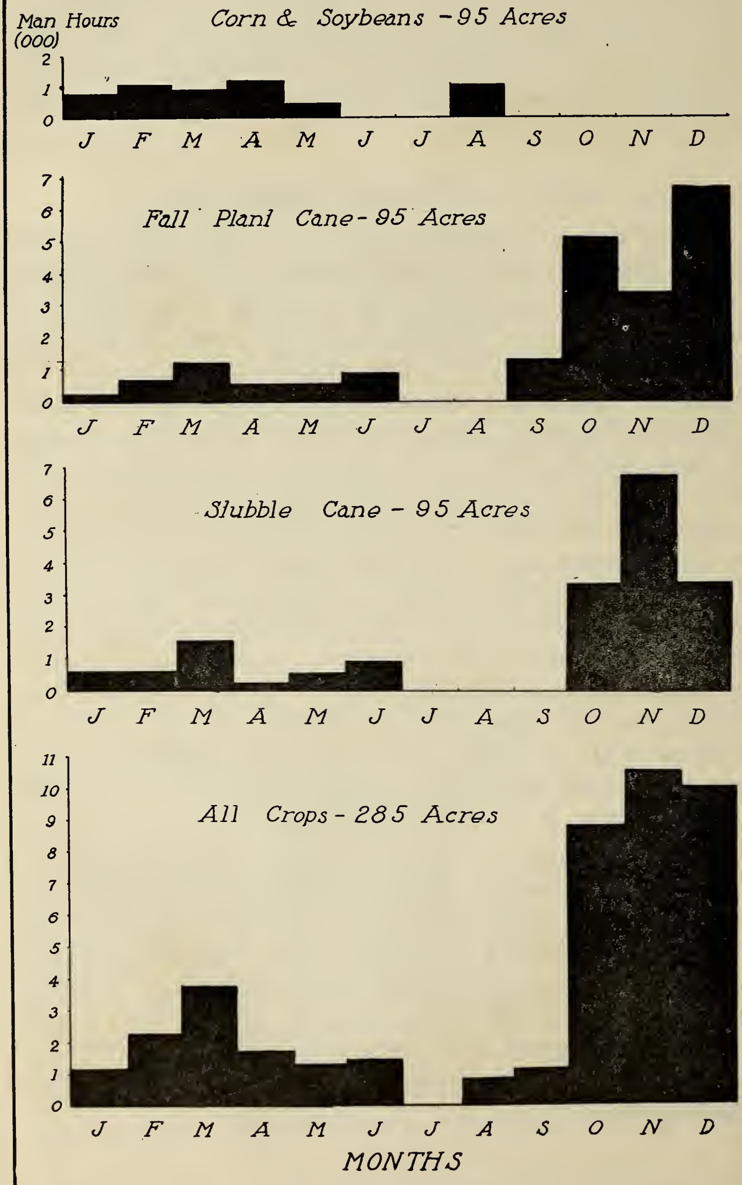


CHART NO. 9

Mule Work Distribution on a 285 Crop Acre Farm in Iberia Parish-1929

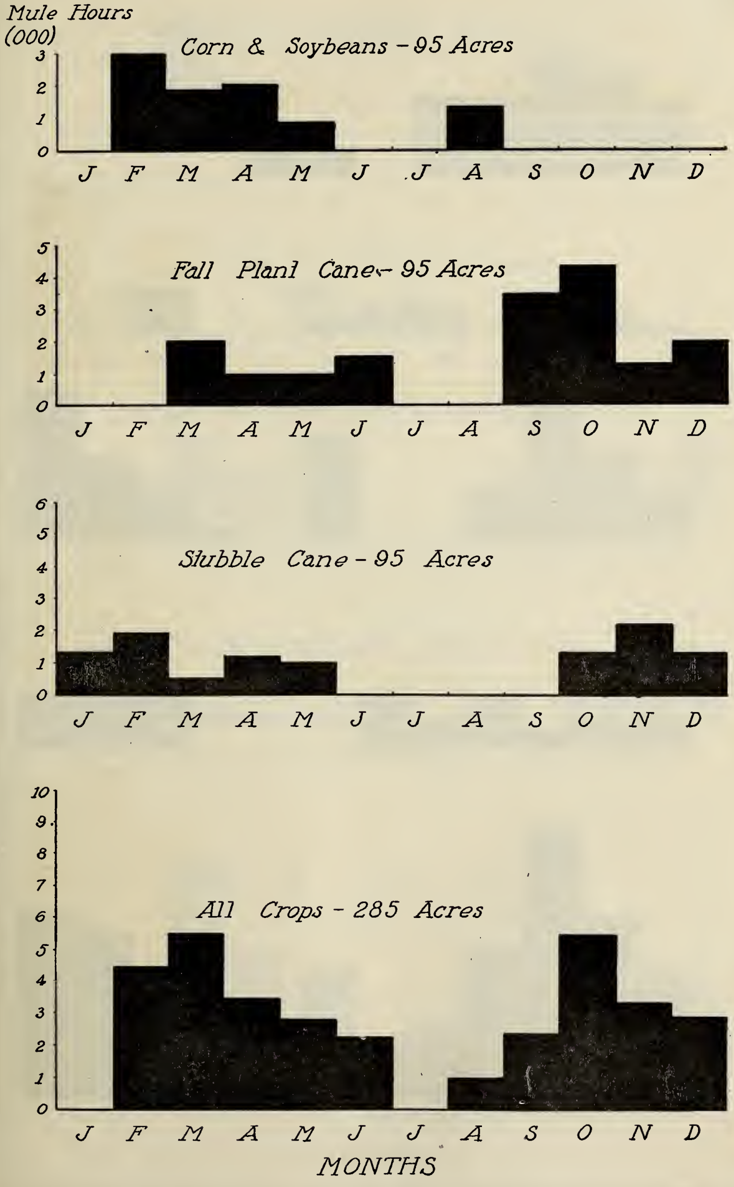


CHART NO. 10

Man Labor Distribution on a 92 Crop Acre Farm in Iberia Parish - 1929

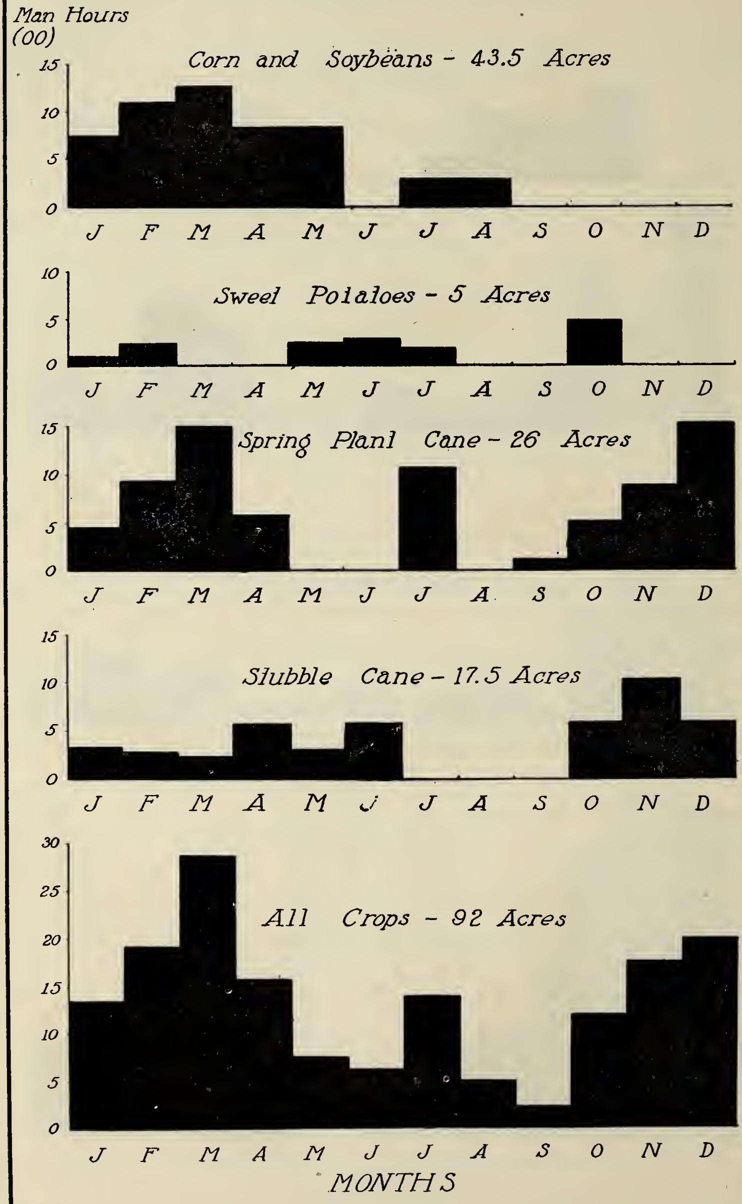
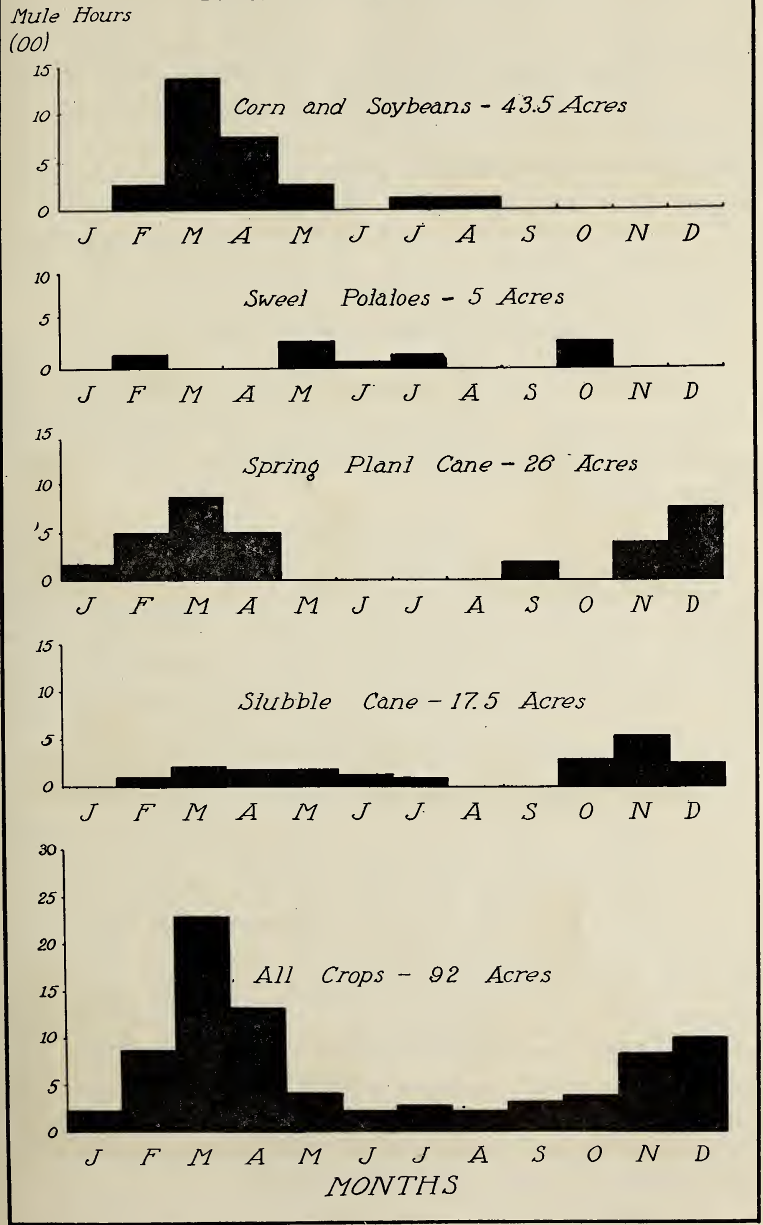


CHART NO. 11
Mule Work Distribution on a 92 Crop Acre
Farm in Iberia Parish -1929



The possibility of getting, by diversification, a labor distribution in which the farm family may participate more fully exists to a limited extent, particularly in the northwestern part of the cane area. In this area cotton and truck crops are now grown to some extent on cane farms with success. The cane areas of the lower sugar bowl are practically limited to truck for secondary crops; yet uncertain market conditions limit the growing of truck. Within these areas diversified systems have been carried on to a limited extent by small farmers, but the possibility of the wide adoption of such systems by any except small sized farms under present conditions is remote.

The crop organization developed by farms of different sizes is presented in Table 1. Cane and corn occupy a large proportion of all tillable land. In spite of the fact that conditions during recent years have been unfavorable to cane growing, other crops have replaced it only to a very limited extent.

CROP YIELDS

Cane yields for 1929 were reduced heavily due to freezes in early December and the subsequent freezes and thaws which followed throughout the month. The exact losses sustained because of low topping, the necessity of windrowing, and from decreased quality and consequently decreased price cannot be determined definitely (Table 2). On the farms under study, the acreage abandoned ranged from .35% on the small family sized farm to 7% on Group C farms (page 6) and 6.71% on large plantations. Small farms had generally progressed further in harvesting at the time of the freeze and consequently suffered a smaller proportionate loss. Those losses, however, do not represent the total tonnage which was left in the field. Estimates have placed the total amount of loss at one-third to one-half of the entire crop. Soybean hay losses were exceptionally large in 1929 due to the ravages of the caterpillars, and many of the sweet potatoes grown in the area were lost due to heavy rains during the fall months. Table 3 gives the percent of each crop planted which was abandoned or from which no return was obtained.

TABLE 1—UTILIZATION OF TILLABLE LAND ON SUGAR CANE FARMS ACCORDING TO SIZE, 1929

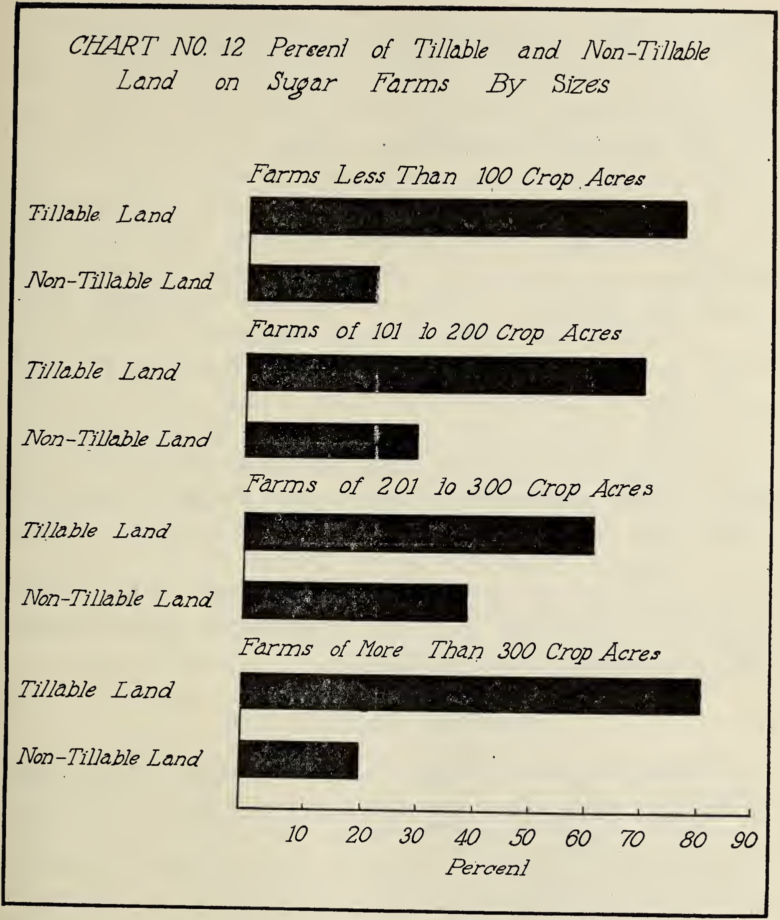
Crop	Farms of 100 Crop Acres or Less	Farms of 101 to 200 Crop Acres	Farms of 201 to 300 Crop Acres	Farms of More than 300 Crop Acres
	Percent of Tillable Land	Percent of Tillable Land	Percent of Tillable Land	Percent of Tillable Land
Fall Plant Cane....	16.1	18.3	20.4	22.7
Spring Plant Cane..	8.1	5.5	6.6	10.7
Stubble Cane	23.4	20.7	23.5	27.2
Total Cane	47.6	44.5	50.5	60.6
Corn	39.1	41.6	35.6	30.9
Soybeans and Peas in Corn	(38.3)	(35.6)	(34.8)	(29.9)
Cotton	5.2	4.2	5.5	1.0
Soybeans and Peas..	....	.9	2.7	2.0
Sweet Potatoes	2.1	1.4	.7	.6
White Potatoes	1.6	.4	.4	....
Truck Crops	1.1	.4	.3	.1
Other Cultivated Crops	....	2.2	....	1.8
Total Cultivated Crops	96.7	95.6	95.7	97.0
Seeded Hay Crops .	.9	1.1	.5	.9
Tillable Pasture ...	2.4	3.3	3.8	2.1
Total Tillable Land	100.0	100.0	100.0	100.0
No. of Farms	18	21	18	17

TABLE 2—DISPOSAL OF 1929 CANE CROP ON 74 LOUISIANA FARMS

	Farms of 100 Crop Acres or Less	Farms of 101 to 200 Crop Acres	Farms of 201 to 300 Crop Acres	Farms of More Than 300 Crop Acres
	Per Cent	Per Cent	Per Cent	Per Cent
Seed	6.4	4.6	5.5	4.6
Left Standing	....	2.4	4.4	5.5
Left in Windrow	.3	1.0	2.6	1.2
Cut and Stripped for Mill	90.4	89.4	75.7	78.7
Cut and Windrow	(3.2)	(3.6)	(14.4)	(11.2)
Strip from Windrowed	2.9	2.6	11.8	10.0
Total	100.0	100.0	100.0	100.0
No. of Farms	18	21	18	17

TABLE 3—CROP ACREAGES NOT HARVESTED ON SUGAR CANE FARMS ACCORDING TO SIZE, 1929

Crop	Farms of 100 Crop Acres or Less	Farms of 101 to 200 Crop Acres	Farms of 201 to 300 Crop Acres	Farms of More Than 300 Crop Acres
	Per Cent	Per Cent	Per Cent	Per Cent
Cane:				
Left Standing	....	2.45	4.42	5.51
Left in Windrow	.35	.98	2.58	1.2
Total	.35	3.43	7.0	6.71
Corn	....	....	....	....
Cotton	....	....	....	....
Soybeans and Peas in Corn	37.21	42.56	66.11	26.73
Sweet Potatoes	7.76	51 43	36.87	45.46
Truck Crops	26.0	27.0	....	....
Irish Potatoes	....	....	....	....



The amount of cane per acre which was saved was slightly larger on small farms than on large plantations, evidently due to the smaller losses incurred on small farms in harvesting rather than to any superior quality of cane grown on these farms. The tonnage saved amounted to a little more than sixteen tons per acre on the large farms and eighteen tons on family sized farms (Table 4). Some idea of the unsatisfactory net returns to be obtained from yields of this type may be had by comparing them with tonnages necessary for profitable operation on actual plantations in 1929. Table 5 shows the tonnage necessary to pay costs of production, calculated with and without interest on invested capital, at $3.50 and $3.75 per ton for cane on ten large plantations operating under the crew system and under a crop rotation of cane and corn. Costs per acre used for growing the crop and for management and overhead are those incurred in 1929. Harvesting is calculated at $1.00 per ton. This is somewhat less than the actual expenditures in 1929, but actually represents costs for a normal year. The tonnage required to defray expenses seems relatively high on these plantations. The large type of plantation may have a high cost for bookkeeping and office overhead but on the other hand they are of a size which has an advantage in securing operating efficiency, in equipment utilization and in purchasing efficiency over smaller sized farms. Quite wide variations occur between individual farms. Farms D and H have a large proportion of the so-called black lands. This fact is reflected in the high cost and consequent high tonnage requirements on these plantations.

LIVESTOCK ORGANIZATION

A small amount of tillable land is set aside for the night pasture of work stock and for the few milch cows which are kept on each farm (Table 1). In addition, however, a considerable proportion of the land is not suited for crops. This amount varies from 19.1% of the total in Group D to 38.5% of Group C with an average of 26.1% for all land included in the study (Chart 12). Since the workstock are for the most part fed in dry lots and are seldom if ever turned out on pasture other than the small permanent pasture near the stables, we may assume that the non-tillable land is all available for the use of other classes of livestock if it is available for any farm use. Table 6 shows the number of each class of livestock now on hand to utilize this feed and the acres used to pasture stock equivalent to

TABLE 4—CROP YIELDS ON SUGAR CANE FARMS, 1929

Crop	Farms of 100 Crop Acres or Less	Farms of 101 to 200 Crop Acres	Farms of 201 to 300 Crop Acres	Farms of More Than 300 Crop Acres
Cane	18.01 T.	16.22 T.	15.93 T.	16.14 T.
Corn	26.99 Bu.	20.61 Bu.	19.91 Bu.	16.97 Bu.
Seed Cotton	513.67 Lb.	561.14 Lb.	596.25 Lb.	351.05 Lb.
Sweet Potatoes	48.50 Bu.	44.57 Bu.	24.76 Bu.	30.90 Bu.
[1]Irish Potatoes	21.07 Bu.	64.10 Bu.	13.78 Bu	.....
Soybeans	.90 T.	1.13 T.	.71 T.	.78 T.
Wild Hay	1.17 T.	.98 T.	1.14 T.	1 07 T.
Alfalfa	.....	1.79 T.	.....	1.82 T.

[1] Yields of Irish Potatoes are from only 9 farms located in the Western Cane Area. They are not representative of the production to be expected under the proper system of management in any part of the area and are very much below the average production for the Southern Cane Area.

one animal unit on the farms in each group.[3] The fact that Groups A and B use much less area per animal unit than the others suggests the possibility of more efficient use of this non-tillable land on the large farms.

The extent to which the individual farmer may increase livestock will depend largely upon the grade of livestock kept, gains under good management, prices, availability of feeds to carry them over the season when pasture is poor, and upon the character of pasture. It often occurs that a large part of a plantation or perhaps a whole plantation is predominantly of black land. The growing of cane on this type of land is in many cases carried on at a loss. These lands may very well be diverted to livestock enterprises at least until such a time as cane varieties or tillage methods for these lands have been developed to the point where cane can be profitably cultivated.

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[3] One animal unit is considered to be equivalent to one mule or horse, one milch cow, one and one-third beef cattle, two young cattle, three sows, four meat hogs, five pigs, seven sheep or one hundred head of poultry.

TABLE 5—CANE TONNAGE REQUIRED TO PAY COSTS AND INVESTMENT CHARGES ON 10 PLANTATIONS BASED ON 1929 PRODUCTION OUTLAYS AND $1.00 PER TON FOR HARVESTING

Plantation	At $3.50 per Ton for Cane		At $3.75 per Ton for Cane	
	Tons to Pay Prod. Outlays and Deprec.	Tons to Pay Prod. Outlays, Deprec., and 6% on Invest.	Tons to Pay Prod. Outlays and Deprec.	Tons to Pay Prod. Outlays, Deprec., and 6% on Invest.
A	23.6	25.2	21.3	22.8
B	26.9	28.5	24.4	25.9
C	24.6	26.2	22.4	23.9
D	29.6	31.2	26.9	28.4
E	21.5	23.1	19.5	21.0
F	23.5	25.1	21.4	22.9
G	28.2	29.8	25.6	27.1
H	34.2	35.8	30.7	32.2
I	25.8	27.4	23.5	25.0
J	28.5	30.1	25.9	27.4

OPERATING EFFICIENCY OF VARIOUS SIZED UNITS

The size of the unit operated may influence in several ways the costs per acre of operating the farm. Small family sized farms may have an advantage in lower overhead outlays such as accounting and office costs. On the other hand they lose the benefits which are forthcoming from the analysis of records that must necessarily be maintained on a larger operating unit.

In respect to power efficiency and the use of machinery, the plantation is better able to adjust its organization to the size and type of machine which most efficiently and cheaply performs the operations. A small farmer, however, may find it cheaper to perform many operations with relatively inefficient tools and equipment rather than purchase the more efficient type which he could not use to capacity. This is especially true in reference to power machines such as trucks, tractors and cane loaders.

TABLE 6—THE ANIMAL UNITS OF LIVESTOCK ON SUGAR CANE FARMS OF DIFFERENT SIZES, 1929

	Farms of 100 Crop Acres or Less	Farms of 101 to 200 Crop Acres	Farms of 201 to 300 Crop Acres	Farms of More than 300 Crop Acres
	Animal Units	Animal Units	Animal Units	Animal Units
Workstock:				
Work Mules	5.75	8.60	14.75	35.58
Pensioners	.06	.24	....	.16
Saddle Stock	.28	.48	1.06	1.24
Others	.05	.28	.38	.12
Total	6.14	9.60	16.19	37.10
Other Livestock:				
Beef Cattle	.08	3.25	2.17	3.66
Milk Cows	3.11	2.90	3.50	5.35
Young Cattle	1.16	1.74	.31	2.12
Hogs	1.56	3.04	3.01	3.75
Sheep	....	.26	.21	.37
Total	5.91	11.19	9.2	15.25
Total Livestock.	12.05	20.79	25 39	52.35
Acres of Non-Tillable Land per Animal Unit of Other Livestock ..	4.1	5.93	17.14	10.66

In the daily operation of the plantation, it is necessary to organize the crew in such a manner that a number of operations may be performed in definite order and at uniform rates. This facilitates supervision and eliminates waste of time which may occur when each laborer's job is frequently changed. For example, one large sized unit used the following crew to carry out the spring planting of cane:

Operation	Men	Mules	Work Done Per Day
Open Row	2	4	10 Acres
Uncover Seed Monkey Out	1	1	Seed to Plant 10 Acres
Shuck and Load	3	..	Seed to Plant 10 Acres
Haul Plant	4	4	10 Acres
Whack	2	..	10 Acres
Cover	2	4	10 Acres

The amount to be done during the day was determined beforehand and each man worked only on his particular phase of the planting operation. Crews of this type may work equally well in multiples of the unit required. By determining the rate of performance of each operation, task work may be assigned on many other operations. Most operators agree that the amount of work done per day is increased and the need of close supervision is decreased when using this unit accomplishment system.

In buying supplies in large quantity economies may be secured for the plantation operator. This results from better information concerning the price situation and advantages in bargaining power. The small farmer must buy in small quantities. He is primarily a laborer instead of a business manager.

THE USE OF POWER MACHINERY

The use of power machinery is a question to the farmer of whether or not he can profitably employ those types of machinery which have proven themselves capable of performing the operations for which they are designed. Of these the use of tractor power is one which seems to offer the greatest economic possibilities.

Tractors have supplied only a small part of the field power used on cane farms in the past. Of the seventy-four farms covered by the survey, five used one tractor and three farms operated with two. The amount of tractor use in 1929 was small as compared with mule work (Tables 14 to 34 in appendix). The introduction of tractors into the cane belt was larger in 1929 than in previous years. Several large units plan to operate with from ten to twenty tractors of various types and sizes during the 1930 season. As a whole, however, cane growers are cautious about replacing a large part of their mules by tractor power. The experience of those operators who have used tractor power in the past will serve as a guide to operators who contemplate making such a change in their farm organization in the near future.

On land which has been idle and is now being returned to crops the question of using all mule power or of using tractor power in part is principally one of the relative costs of the two types. Reclaiming idle land for sugar cane production requires one or two years at the most. Consequently, the operator must consider not only the original outlay for tractors and tractor equipment but also the efficient use after the rebreaking work has been completed. On plantations now using mules the question is one of tractor costs versus possible savings in the replacement of mule power and man labor. The size of farm or the amount of work which there is for the tractor to do will materially affect the cost of operating it. A large number of work days during the year over which to distribute overhead costs is necessary to obtain a low cost per day. A large farm has the further advantage in that a man who is more efficient than ordinary labor in operating and managing tractors may be employed to good advantage, while a small farm would not have enough tractor work to justify the larger wage expenditure.

Savings made possible by the introduction of tractors may occur in man labor eliminated and in lower mule costs. The amount of man labor saved will depend upon the rate of performance of the tractor as compared with that of mules. Saving on mule costs may be effected in two ways. A number of mules may be taken off the plantation or eliminated from the organization. Again, tractors must replace mules at the time when the demand for mule work is greatest. This usually occurs during harvest season. Tractors have not been used to any extent in harvesting sugar cane although motor trucks are gaining favor in the area. If mules must be maintained for harvesting purposes, then their use for producing the crop involves only those additional outlays. It is this condition which offers the greatest resistance to the increased use of tractors on sugar cane farms. For mules displaced entirely the outlay for maintenance is saved. Even though the number of mules is the same a saving may be made in feed consumption and a decreased rate of depreciation on mules brought about by having the tractor to perform the heavy work. To make a comparison of these factors it is necessary to have a knowledge of the cost of operation of various types and sizes of tractors together with costs of mule maintenance and the rate of performance for operations done by them.

There are in general two types of operations performed on cane or corn by tractors. The first includes those cultivation operations in which the tractor goes between the rows. These operations are performed by small tractors of about a 10-20 rating. As a rule this small tractor will be used to some extent in plowing the land and building up the row, but the power is not sufficient to do extremely heavy work. The second type or straddle row operations are usually performed by a somewhat larger machine, one of 15-30 rating or larger. The preparation of the land, building up of rows, and the plowing of heavy lands are operations to which this more powerful type of tractor is best adapted.

On the farms under study tractors used were of the wheel type. The small sized tractors are equipped with narrow gauge wheels to facilitate working between the cane rows. A number of caterpillar tractors have recently been brought into use in the area, but have not yet been used a sufficient length of time to furnish reliable data concerning their performance and their costs.

Table 7 presents the rate of performance for each size of tractor and the number of mules and men which will normally be necessary to do the same operation at the rate given. These replacements do not take into consideration abnormal soil conditions or work on extremely heavy soils. It is assumed that only one man is needed to operate the tractor and lister in capping off sugar cane land. In capping off, two men will be necessary if the lister is not of the type which can be controlled from the tractor.

TRACTOR COSTS

The size of farm is one factor which improves the adjustment in the usage of the tractor. Only two farms studied which had less than 300 crop acres used tractor power and these two received relatively uneconomic usage from the tractor. This does not assume that a large farm is all that is necessary to get efficient usage, for several large planters had high costs. But it does indicate that the most economical adjustment for a tractor outlay comes on the larger plantations. These two smaller farms were eliminated from the analysis so that all comparisons might be made on farms of similar size.

Wide variations occur between the outlay per hour for operating similar tractors on different farms. Estimating the life of the tractor at six years and depreciating it accordingly, cost per ten hour day for 10-20 wheel tractors, including the operator, was $7.90 (Table 8). These tractors were used an average of 112 days during the year. The extremes of cost were $12.66 per day for a tractor used only thirty-one days and $6.49 per day for one used 177 days. The chief difference in the cost is due to the disposition of

TABLE 7—RATES OF ACCOMPLISHMENT, MEN AND MULES REPLACED BY 10-20 AND 15-30 TRACTORS IN THE SUGAR CANE AREA, 1929

Operation	Implement	Number of Men	Acres Per Day	Mules Replaced	Men Replaced
10-20 Tractors:					
Cap Off	22 Inch Lister	1	8.3	4	2
Build Up Row	Thompson Plow	1	12.1	8	4
Cultivate and Break Out Light	Thompson Plow	1	10.8	6	3
Cultivate and Break Out Deep	Thompson Plow	1	8.5	8	4
Off Bar	Thompson or Oliver Plow	1	8.0	4	2
15-30 Tractors:					
Cap Off	22 or 24 Inch Lister	1	15.0	8	4
Cap Off and Build Row	Thompson Plow	1	9.0	12	4
Disc (flat)	8 Foot Tandem	1	14.2	8	2
Flat Break	3 Bottom Gang	1	8.3	8	2

TABLE 8—COST PER 10 HOUR DAY FOR OPERATING 10-20 AND 15-30 TRACTORS ON SUGAR CANE PLANTATIONS, 1929

Cost Iems	Tractors Having 10-20 Rating	Tractors Having 15-30 Rating
Gas	$3.37	$ 4.40
Oil	.26	.41
Grease	.04	.06
Repairs (labor and parts)	.50	.53
Chore Labor (@ 11c per hour)	.09	.11
Depreciation (6 year life)	1.51	2.89
Interest—8%	.58	1.08
Operator	1.55	1.79
Total	$7.90	$11.27
Total Days	783.9	400.0

the overhead expense resulting from poor adjustment in tractor use. Larger tractors of the 15-30 rating were used on an average of eighty days per year and cost $11.27 per day, including the operator. In this case also, costs per day were reduced as the tractor utilization was better adjusted to the organization.

	Days Used Per Year	Cost Per Day Including Operator
Least Used 15-30 Tractor	46	$18.16
Most Used 15-30 Tractor	126	8.08

Practically every tractor owner has found it economical to pay more than labor wages in order to have an operator who is sufficiently skilled to handle the machine with minimum of breakage. The average wage paid was $1.55 per day to operators of the small size tractor and $1.80 to those of the larger type as compared with $1.00 to $1.25 per day for ordinary labor. The fuel and oil consumption by a tractor will depend somewhat on the age and repair of the motor and upon the type of work being performed. The average consumption for tractors studied is a follows:

Size of Tractor	Gas Per Ten Hour Day—Gallons	Oil Per Ten Hour Day—Quarts
10-20 Tractors	20.4	1.9
15-30 Tractors	24.6	2.7

At the present time gasoline is used almost exclusively as tractor fuel in the sugar cane area. Only one tractor among those studied used kerosene. This operator, however, did not decrease his cost because of the relatively high price paid for kerosene. The use of a low grade fuel even though the fuel cost per day may be decreased will be discouraged if it results in a greater wear on the tractor. Cheaper fuels, such as the distillate, and tractors more suited to distillate consumption may be a development of the near future. Should this come about the costs of operation will be somewhat decreased.

MULE COSTS

Mule power is the only type now in use on a large majority of the farms of the cane belt, and even on farms which are using tractors, the greater part of the work is performed by mules. Consequently cost of mule power is one of the major cost items on every cane plantation. Keeping this cost at a minimum per acre or per hour depends upon the outlay necessary to maintain work stock and upon the amount of work done by them.

Feeding practices vary between farms of various sizes and between farms using tractors as compared with those using mule power exclusively. The data presented in Chart 13 indicates that the total amount of concentrated feeds per mule does not vary greatly with size of farm. The annual consumption of concentrates is between 8,000 and

CHART NO. 13

Amounts and Kinds of Feed Per Mule on Non-Tractor Farms By Size Groups—1929

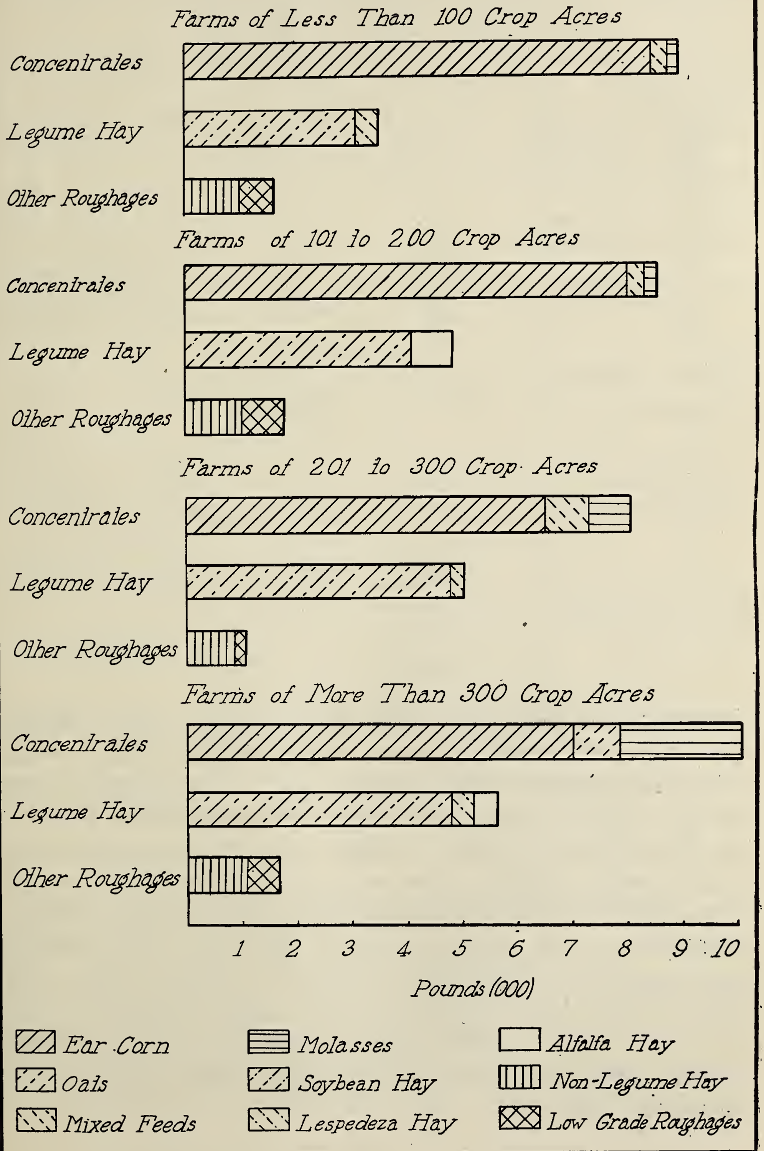


TABLE 9—FEED PRICES PAID ON FARMS OF DIFFERENT SIZES IN THE SUGAR CANE AREA, 1929

Feeds	Farms of 100 Crop Acres or Less	Farms of 101 to 200 Crop Acres	Farms of 201 to 300 Crop Acres	Farms of More Than 300 Crop Acres
Concentrates:				
Ear Corn per Cwt.	$1.11	$1.10	$1.15	$1.07
Ground Corn per Cwt.	....	....	1.22	1.21
Ground Oats per Cwt.	....	....	....	2.00
Molasses per Cwt.	.92	.84	.99	.98
Mixed Feed per Cwt.	2.25	1.86	2.70	....
All Concentrates per Cwt.	1.14	1.11	1.27	1.15
Hay:				
Soybean Hay per Ton	13.80	14.38	13.56	12.26
Alfalfa Hay per Ton	....	16.02	....	21.25
Lespedeza Hay per Ton	14.67	....	11.90	20.00
Wild Hays per Ton	15.11	10.58	9.32	9.22
All Hays per Ton	14.13	12.57	12.95	12.53
Low Grade Roughages per Ton	7.17	7.38	4.00	4.00

10,000 pounds per mule. The larger farms feed a higher percentage of ground feeds, molasses and mixed feeds which have greater feed value per pound than has ear corn. Prices paid for corn are lower on plantations, but the grinding of the feed and a higher proportion of mixed feed tend to make a higher price per pound of concentrates and, consequently, a somewhat higher feed cost per mule (Tables 9 and 10). The amount of hay fed per mule increases quite regularly with the size of farm. In general the plantations feed a larger quantity and a better quality of feed per mule than do small farms. This difference in feeding practice amounts to about $35.00 per head difference in outlay per year.

TABLE 10—ITEMS OF OUTLAY PER MULE ON SUGAR CANE FARMS OPERATED WITHOUT TRACTORS, 1929

Outlays	Farms of 100 Crop Acres or Less	Farms of 101 to 200 Crop Acres	Farms of 201 to 300 Crop Acres	Farms of More Than 300 Crop Acres
Feed Outlays:				
Concentrates	$ 84.64	$ 91.32	$101.31	$119.17
Roughages	33.78	36.30	38.48	35.63
Total Feeds . ..	$118.42	$127.62	$139.79	$154.80
Other Outlays:				
Chore Labor	11.24	9.63	18.25	15.10
Veterinary and and Medicine . ..	1.28	.96	1.40	3.45
Shoeing	1.07	.94	1.51	1.07
Gears—Upkeep . ..	1.71	2.93	3.37	4.18
Total Other Outlays	$ 15.30	$ 14.46	$ 24.53	$ 23.80
Interest and Dep.:				
Dep. and Death Losses	18.01	11.92	18.44	19.49
Int. on Investment in Workstock at 8%	8.99	9.74	13 45	10.86
Int. on Investment in Gears at 8%	.36	.57	.59	.58
Total Interest and Dep.	$ 27.36	$ 22.23	$ 32.48	$ 30.93
Total Outlay . ..	$161.08	$164.31	$196.80	$209.53
No. of Workstock...	91	167	271	434
No. of Farms.......	15	17	16	11

Marked differences occur in the quantity of both concentrates and roughage fed on tractor and non-tractor farms. The number of pounds per head is less on those farms that used tractors and tractor machinery. This difference, however, is completely offset by the fact that tractor farms feed more prepared and processed feeds. This processing was reflected in high unit prices for feeds,

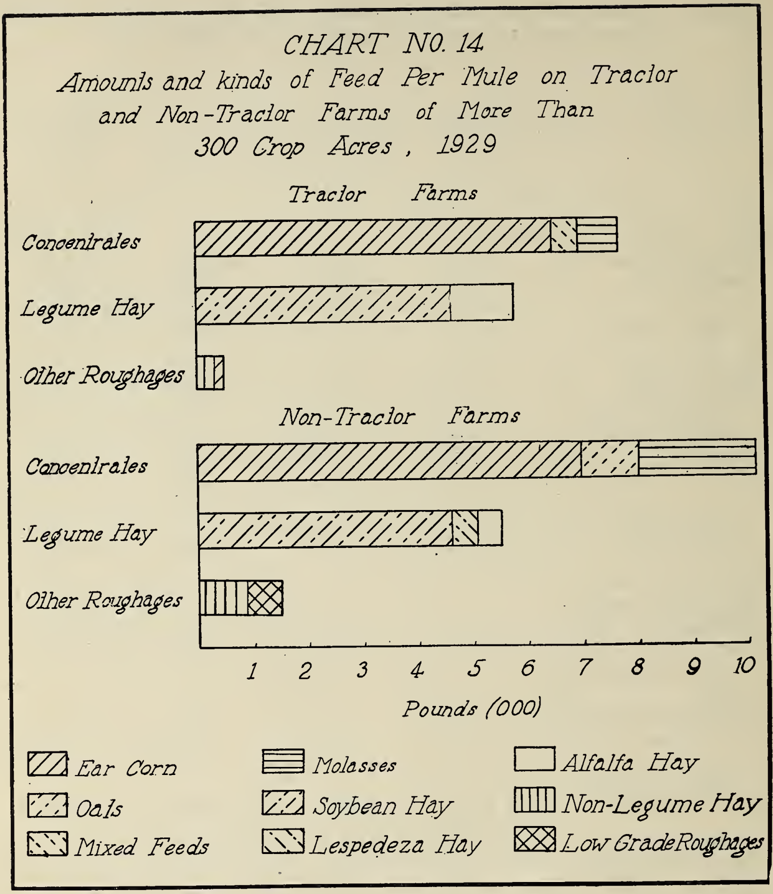


CHART NO. 14
Amounts and kinds of Feed Per Mule on Tractor and Non-Tractor Farms of More Than 300 Crop Acres, 1929

making the total feed costs on the two types of farms practically identical. This comparison applies to farms of similar sizes (Chart 14, Tables 11 and 12).

Plantation operators as a rule have a better class of mule than do small farmers, and are somewhat more careful in caring for injuries. This is reflected in relatively higher charge for interest on investment and larger outlays for veterinary expenses and other items. When tractors can be used for much of the heavier work, depreciation charges and costs for veterinary and medicine tend to

TABLE 11—FEED PRICES PAID ON TRACTOR AND NON-TRACTOR FARMS OF SIMILAR SIZE IN THE SUGAR CANE AREA, 1929

Feeds	Tractor Farms	Non-Tractor Farms
Concentrates:		
Ear Corn per Cwt.	....	$ 1.07
Ground Corn per Cwt.	$ 1.31	1.21
Ground Oats per Cwt.	....	2.00
Molasses per Cwt.	.91	.98
Mixed Feed per Cwt.	2.50	....
All Concentrates per Cwt.	1.36	1.15
Hay:		
Soybean Hay per Ton	17.73	12.26
Alfalfa Hay per Ton	15.00	21.25
Lespedeza Hay per Ton	....	20.00
Wild Hays per Ton	10.00	9.22
All Hays per Ton	17.17	12.53
Low Grade Roughages per Ton	9.35	4.00

decrease. The amount of depreciation on each farm will depend, in addition to the amount of heavy work done, upon the age of the mules kept. Although mules are commonly worked for the whole period of their usefulness on the plantation where they are first purchased, several men have been able to practically eliminate depreciation by purchasing young mules and working them for two or three years and then selling them at their prime for as much or more than their original cost. One tractor farm carried out such a method which accounts in part for the low depreciation on these farms (Table 12). Chart 15 shows the relationship between cost per head and mule cost per acre on all non-tractor farms.

Mule costs per acre will depend upon the factor of adjustment as well as upon the outlays for keeping mules. Chart 16 shows the relationship between crop acres worked per mule and costs of mule work per acre. The cost per day of mule work will depend likewise upon total days

TABLE 12—ITEMS OF OUTLAY PER MULE ON SUGAR CANE FARMS OF SIMILAR SIZE OPERATING WITH AND WITHOUT TRACTORS, 1929

Outlays	Tractor Farms	Non-Tractor Farms
Feed Outlay:		
Concentrates	$104.16	$119.17
Roughages	50.09	35.63
Total Feeds	$154.25	$154.80
Other Outlays:		
Chore Labor	13.22	15.10
Veterinary and Medicine	1.63	3.45
Shoeing	1.33	1.07
Gears—Upkeep	4.22	4.18
Total Other Costs	$ 20.40	$ 23.80
Interest and Depreciation:		
Depreciation and Death Losses	6.87	19.49
Interest on Investment in Workstock at 8%	11.82	10.86
Interest on Investment in Gears at 8%	.60	.58
Total Interest and Depreciation	$ 19.29	$ 30.93
Total Outlay	$193.94	$209.53
Number of Workstock	197	434
Number of Farms	6	11

worked per year and upon cost of maintenance. The relationship between the days worked per year and cost per day is shown in Chart 17. To get lower cost per day, it is desirable to get a better adjustment between mules and crops handled. The large sized farms, while they have a higher outlay per mule, worked each mule more days per year. The annual number of days of work per mule for Group A, B, C, and D was 124, 142, 145, and 153 respectively. These counteracting factors tend to maintain the cost per hour for mule work at nearly the same level on all farms. The outlay per day for mule work is as follows:

Size of Farm	Outlay for Mule Work Per 10- Hr. Day
Farms of less than 100 crop acres	$1.43
Farms of 100 to 199.9 crop acres	1.14
Farms of 200 to 299.9 crop acres	1.37
Farms of more than 300 crop acres	1.37

CHART NO. 15 - Relationship Between The Per Head Cost of Maintaining Mules and The Power Cost Per Crop Acre on 65 Sugar Cane Farms, 1929

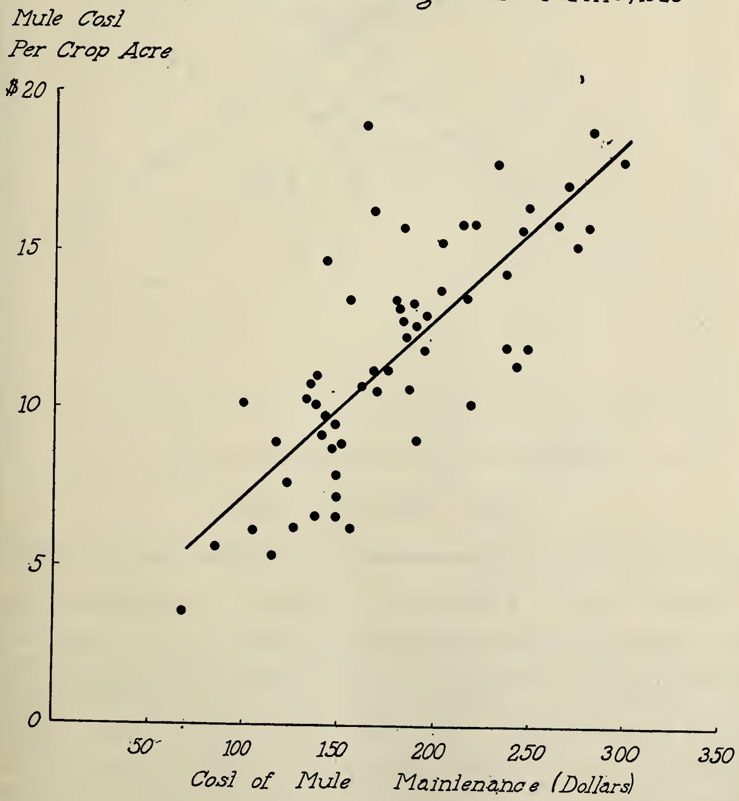
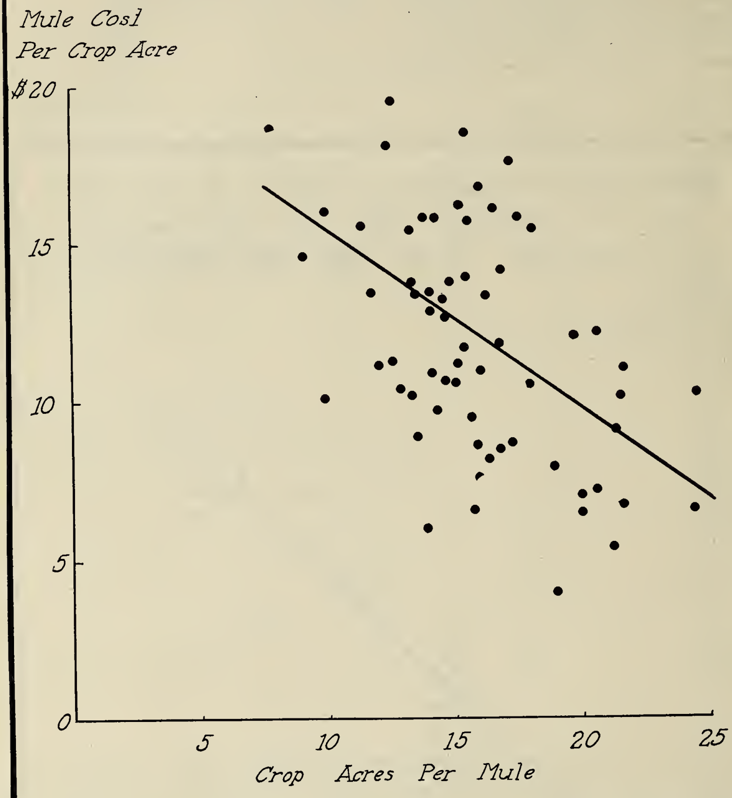


CHART NO. 16 - Relationship Between Crop Acres Worked Per Mule and The Cost of Power Per Crop Acre On Farms Operating Without Tractors



There may be a tendency on many plantations to use the tractor at tasks which might be done more economically by mule work, that is, to use the tractor while the mules are idle in the lot. This practice was not apparent on the farms under study. The farms of a similar size worked mules the same number of days per year irrespective of tractor use. On the tractor farms mules worked 153 days per year on the average. Due to the somewhat lower out-

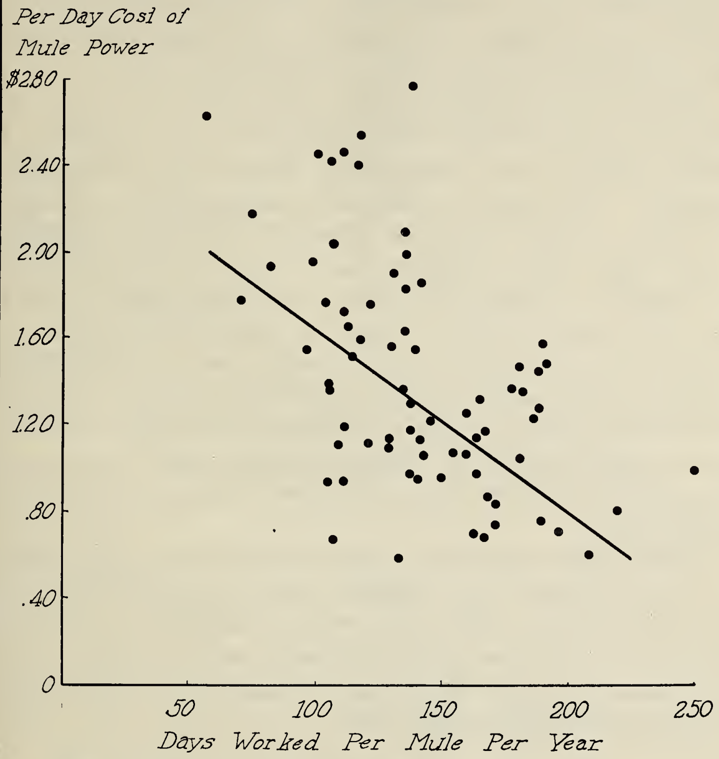


CHART NO. 17—Relationship Between Days Worked Per Mule and Cost Per Day of Mule Labor

lays on tractor farms the rate per day for mule work was lower, being $1.26 per day as compared with $1.37 on non-tractor farms.

The crop acres worked per mule was higher on those units having a tractor in the organization. Tractor farms worked 20.0 acres per mule and non-tractor farms 16.3 acres. The total power cost per acre was $11.24 on tractor farms and $12.86 on non-tractor farms. The decreased cost per head for maintenance accounted for $.76 of this difference, and the replacement of more mules than was necessary to pay tractor costs, $.86. In addition some saving in man labor was also made by tractor use. This decreased cost is an average condition. Much larger savings were made on some farms while others raised their cost per acre by using the tractor. The range was from a loss of $2.83 per acre to a gain of $5.76 per acre.

Although the average results obtained by the use of tractors on these farms were satisfactory, the number of tractor farms is not sufficiently large to be considered conclusive. The factor of personal management is so significant that it may materially influence the results obtained on each farm. This applies alike to the handling of mules and tractors. There are several limiting factors which enter into this problem. First, no single type or size of tractor unit has been developed which can do all cultural operations that tractors need to perform in order to replace mules on cane farms. Again, possibility for power machinery to replace mules is reduced because each farm unit must maintain enough men and mules to meet cane harvest requirements.

Comparative cost data presented will serve as a basis for more thorough and detailed work along the line of power utilization. This work will be facilitated as larger numbers of machines are introduced and as new types, which have only recently been introduced into the area, are given a more thorough trial.

CANE LOADERS

Field loaders used on farms were all of the mule drawn type equipped with four to six horse-power gas engines. The loader moved by mechanical power has made its appearance recently in the cane belt, but is not yet commonly used. This power driven machine offers possibilities for further development.

From data collected on the mule drawn type operated with a crew of five men and four mules, the cost per ton for performing this operation was 13.3 cents (Table 13). This is considerably below hand loading costs which,

TABLE 13—ITEMS OF OUTLAY IN THE OPERATION OF CANE LOADERS, 1929

Items	Cost Per Ton	Cost Per 10 Hour Day
	Cents	Dollars
Gas	.9	1.02
Oil	....	.15
Grease	....	.01
Repairs	.2	.02
Man Labor	6.9	7.97
Mule Power	3.7	4.30
Total Operating	11.7	13.47
Depreciation	1.0	1.16
Interest @ 8%	.6	.69
Total Outlay	13.3	15.32
Gallons Gas	....	4.48
Quarts Oil	....	.97
Tons Loaded	....	115.00
Size of Crew:		
Men	....	5
Mules	....	4

assuming eight tons per man for a day, would amount to 18¾ cents at $1.50 per day or 21.9 cents at $1.75 per day.

The loaders as operated handled 115 tons of cane per day. This amount is somewhat below the capacity which several operators have obtained. Costs per ton depend on tons handled per day and upon the total amount loaded per season. It is imperative that a sufficiently large number of wagons be available to keep the loader in constant operation. Maximum efficiency will come also with constant use during the harvesting season. These factors tend to more efficient use on large plantations although the difference in costs between power and hand loading is large enough that many medium sized farms may find loader use profitable even though operated at a relatively higher cost than on large plantations.

SUMMARY

1. The price of agricultural products has been relatively low when compared with the price of the commodities which farmers purchase and is only slightly higher when related to the price of all non-agricultural products.
2. When compared with a pre-war base, 1913, the prices of sugar, rice, and corn are lower than those of cotton, sweet potatoes, white potatoes, veal, and beef.
3. The man labor and mule use requirements of the various crops grown in the cane area are not greatly influenced by the size of the unit operated.
4. Differences in soil types, in plantation layout, and in the managerial ability of individual operators seem to be factors which account for the wide differences in labor and power requirements between individual farms.
5. Cotton, corn, sweet potatoes, white potatoes, and truck crops when included in the crop organization of a cane farm lend themselves to the efficient utilization of machinery. Rice, however, cannot be readily incorporated in the farm organization due to the large amount of specialized machinery which it requires.
6. Under a crop system of corn and cane the labor and power requirements are high during the early spring months and during harvest. These requirements can be shifted somewhat from fall to spring or vice versa by regulating the time of planting cane. Any further smoothing of labor and power distribution will depend upon the efficient use of power machinery for cultural operations and upon the development of efficient harvesting machines. This latter factor is the limiting one at present.
7. Under the existing scale of prices the income at present cane yields has not been sufficient to defray outlays for production.

8. The possibility of profitably increasing the amount of livestock exists on plantations having a large proportion of black land and on those which do not have ready access to a sugar house.
9. Large sized plantations have an advantage in machinery utilization, in crew organization and in purchasing efficiency over small sized units.
10. Operating costs for the inter-row tractors studied amounted to $7.90 per ten hour day while straddle row or 15-30 tractors required outlays of $11.27 per day. Due to the disposition of overhead charges costs incurred on individual farms varied inversely with the amount each tractor was used per year.
11. The cost of mule maintenance varied from $161.00 per head on family sized farms to $210.00 on plantations of more than 300 crop acres operating without tractors. Increased quantities and better quality feed account for a large part of this difference.
12. Plantations using tractors had less depreciation on mules, a lower death loss, and lower veterinary charges than plantations of a similar size operating without tractors. These differences lower the cost of mule maintenance on tractor farms by $16.00 per head.
13. Tractor farms worked twenty crop acres per mule while non-tractor farms of the same size worked sixteen crop acres.
14. The replacement of mules by tractors and the reduced cost of mule maintenance due to tractor use, was such, on the average, that the total power costs per acre, including tractor outlays, was lower on those farms employing tractors than on those using mules only. Several farms included, however, raised rather than lowered their power costs by using tractors.
15. The fact that tractors have not been able to replace mules during harvest and that no single type or size of tractor has been developed which will efficiently perform all the cultural operations on cane are the

factors which limit extensive use of tractors on cane farms. Further study of larger numbers of machines and of new types of tractors will be necessary to determine more definitely the place which tractor power should occupy in the organization of sugar cane farms.

16. Field cane loaders on the farms studied were operated at a cost of 13.3 cents per ton. This is considerably below hand loading costs.

STATISTICAL APPENDIX

Much of the detailed statistical data upon which the conclusions of this study rest are self explanatory. These are included in the statistical appendix for reference purposes.

TABLE 14—SUMMARY OF MAN LABOR REQUIREMENTS PER ACRE, SUGAR CANE AREA, 1929

Crop	Farms of 100 Crop Acres or Less	Farms of 101 to 200 Crop Acres	Farms of 201 to 300 Crop Acres	Farms of More than 300 Crop Acres	Average of All Farms
	Man Hours	Man Hours	Man Hours	Man Hours	Man Hours
Fall Plant Cane	92.45	95.13	89.66	82.77	86.56
Spring Plant Cane	86.16	84.10	126.55	88.99	94.55
Stubble Cane	44.66	48.71	58.56	47.22	49.59
Harvesting Cane:					
Cut and Strip (per ton)	4.71	5.78	5.98	5.05	....
Load and Haul (per ton)	1.49	1.43	1.58	1.47	....
Corn:					
Growing	33.44	27.96	31.75	26.71	28.67
Harvesting	9.73	7.63	9.36	7.53	8.15
Cotton:					
Growing	48.57	55.65	66.28	53.30	58.73
Harvesting	40.60	58.38	85.30	35.86	62.91
Sweet Potatoes:					
Growing	44.92	33.67	45.69	31.37	37.55
Harvesting	29.49	12.51	27.51	17.09	20.57
Soybean Hay (in corn)	17.80	14.61	11.63	14.06	14.14
Lespedeza and Wild Hays	25.64	10.74	16.23	23.49	17.91

TABLE 15—SUMMARY OF POWER REQUIREMENTS PER ACRE, SUGAR CANE AREA, 1929

Crop	Farms of 100 Crop Acres or Less		Farms of 101 to 200 Crop Acres		Farms of 201 to 300 Crop Acres		Farms of More than 300 Crop Acres		Average of All Farms	
	Mule Hours	Tr. Hours	Mule Hours	Tr. Hours	Mule Hours	Tr. Hours	Mule Hours	Tr. Hours	Mule Hours	Tr. Hours
Fall Plant Cane	92.45	....	92.30	.02	88.61	.10	76.39	.71	82.37	.44
Spring Plant Cane	72 90	....	83.61	....	88.82	1.97	82.02	.83	82.68	.88
Stubble Cane	43.05	....	51.74	....	59.25	.55	40.21	.72	45.90	.54
Harvesting Cane:										
Load and Haul (per ton)	2.92	....	3.41	....	3.28	....	3.18	....	....	....
Corn:										
Growing	45 16	....	41.74	.04	45.25	.30	35.71	.53	39.86	.33
Harvesting	8.53	....	7.08	....	7.38	....	4.82	....	6.17	....
Cotton:										
Growing	48.83	....	47.92	....	67.31	.57	35.38	.88	53.83	.42
Harvesting	3.72	....	1.67	....	.46	1.08*	.26	.12*	1.15	.48*
Sweet Potatoes:										
Growing	39.93	....	33.22	....	35.59	....	23.57	.94	31.40	.34
Harvesting	14.87	....	8.35	....	13 30	.17*	2.19	.64	8.37	.04* .23
Soybean Hay (in corn)	9.61	....	11.84	....	8.15	....	6.58	....	8.10	....
Lespedeza and Wild Hays	32.73	....	11.06	....	18.44	....	19.75	....	17.96	....

*Truck Hours.

TABLE 16—MAN LABOR REQUIREMENTS ON 1 ACRE OF FALL PLANT CANE PRIOR TO HARVEST, LOUISIANA, 1929

Operations	Farms of 100 Crop Acres or Less	Farms of 101 to 200 Crop Acres	Farms of 201 to 300 Crop Acres	Farms of More than 300 Crop Acres	Average of All Farms
	Man Hours	Man Hours	Man Hours	Man Hours	Man Hours
1. Main Drains and ditches	8.02	3.85	5.82	5.85	5.71
2. Quarter drains	6.11	8.00	7.02	7.02	7.12
3. Land preparation	7.90	8.44	9.25	7.72	8.16
4. Cut and strip seed	8.93	10.68	12.07	9.09	9.96
5: Plant	14.24	21.05	13.96	14.62	15.35
6. Harrow, drag and roll	1.31	.79	.64	.16	.42
7. Off bar operations	10.16	6.43	4.63	5.46	5.69
8. Hoe	17.86	17.21	15.84	16.39	16.47
9. Fertilize	.14	.79	.21	1.60	1.11
10. Cultivate mold	11.68	10.94	11.33	7.48	9.04
11. Cultivate sulky	5.01	3.26	6.91	4.54	4.89
12. Knife middles	.55	2.43	....	....	.38
13. Water boy	....	.81	1.94	2.45	1.96
14. Other operations	.54	.45	.04	.39	.30
Total Man Labor	92.45	95.13	89.66	82.77	86.56
Acres	256.68	616.48	941.72	2,566.76	4,381.64

TABLE 17—POWER REQUIREMENTS ON 1 ACRE OF FALL PLANT CANE PRIOR TO HARVEST, LOUISIANA, 1929

Operations	Farms of 100 Crop Acres or Less		Farms of 101 to 200 Crop Acres		Farms of 201 to 300 Crop Acres		Farms of More than 300 Crop Acres		Average of All Farms	
	Mule Hours	Tr. Hours	Mule Hours	Tr. Hours	Mule Hours	Tr. Hours	Mule Hours	Tr. Hours	Mule Hours	Tr. Hours
1. Main drains and ditches	.02	....	....	....	.34	....	.37	....	.30	....
2. Quarter drains	2 56	....	3.18	....	2.34	....	2.59	....	2.63	....
3. Land preparation	17.38	....	19.11	.02	19.62	.05	15.76	.28	17.15	.18
4. Cut and strip seed	....	....	....	....	....	....	....	....	....	....
5. Plant	17.91	....	23.36	....	16.52	....	16.92	....	17.79	....
6. Harrow, drag and roll	2.55	....	1.75	....	1.28	....	.32	....	.86	....
7. Off bar operations	20.30	....	13.19	....	9.26	....	10.74	.09	11.33	.05
8. Hoe	....	....	....	....	....	....	....	....	....	....
9. Fertilize	.29	....	.34	....	.36	....	2.86	....	1.82	....
10. Cultivate mold	23.15	....	23.13	....	22.97	.05	14.33	.34	17.95	.21
11. Cultivate sulky	10.13	....	6.53	....	13.82	....	9.09	....	9.81	....
12. Knife middles	....	....	....	....	....	....	....	....	....	....
13. Water boy	....	....	.81	....	1.94	....	2.45	....	1.97	....
14. Other operations	1.37	....	.90	....	.16	....	.96	....	.76	....
Total	95.66	....	92.30	.02	88.61	.10	76.39	.71	82.37	.44
Acres	256.68	....	616.48	....	941.72	....	2,566.76	....	4,381.64	....

TABLE 18—MAN LABOR REQUIREMENTS OF 1 ACRE OF SPRING PLANT CANE PRIOR TO HARVEST, LOUISIANA, 1929

Operations	Farms of 100 Crop Acres or Less	Farms of 101 to 200 Crop Acres	Farms of 201 to 300 Crop Acres	Farms of More than 300 Crop Acres	Average of All Farms
	Man Hours	Man Hours	Man Hours	Man Hours	Man Hours
1. Main drains and ditches	2.68	2.12	6.48	5.53	5.14
2. Quarter drains	13.80	12.16	6.08	8.18	8.64
3. Cut, windrow and cover seed	6.55	4.28	8.17	6.28	6.41
4. Land preparation	5.87	7.95	7.47	6.30	6.63
5. Uncover and shuck seed	6.64	3.89	4.22	4.85	4.77
6. Plant	15.80	18.22	20.52	17.54	17.98
7. Harrow, drag and roll	1.63	1.87	1.48	.20	.68
8. Off bar operations	5.66	5.44	8.00	5.68	6.04
9. Hoe	15.12	10.99	46.87	19.09	22.61
10. Fertilize	....	....	....	.15	.10
11. Cultivate mold	9.66	11.80	11.09	7.94	8.98
12. Cultivate sulky	2.62	4.91	4.30	5.43	4.99
13. Knife middles	....	.44	.86	....	.19
14. Water boy	....	....	.75	1.82	1.33
15. Other operations	.13	.03	.26	....	.06
Total Man Labor	86.16	84.10	126.55*	88.99	94.55
Acres	128.92	186.32	303.78	1,206.84	1,825.86

*High requirements result of extra hoeing done on one farm.

TABLE 19—POWER REQUIREMENTS OF 1 ACRE OF SPRING PLANT CANE PRIOR TO HARVEST, LOUISIANA, 1929

Operations	Farms of 100 Crop Acres or Less		Farms of 101 to 200 Crop Acres		Farms of 201 to 300 Crop Acres		Farms of More than 300 Crop Acres		Average of All Farms	
	Mule Hours	Tr. Hours	Mule Hours	Tr. Hours	Mule Hours	Tr. Hours	Mule Hours	Tr. Hours	Mule Hours	Tr. Hours
1. Main drains and ditches	....	....	....	....	....	....	.23	....	.15	....
2. Quarter drains	2.86	....	3.85	....	2.43	....	4.23	....	3.79	....
3. Cut, windrow and cover seed	1.38	....	1.15	....	1.17	....	2.24	....	1.89	....
4. Land preparation	11.75	....	16.45	....	15.79	.48	12.50	.36	13.40	.32
5. Uncover and shuck seed	1.80	....	1.61	....	1.58	....	1.68	....	1.67	....
6. Plant	15.44	....	12.45	....	20.35	.32	21.37	....	19.87	.05
7. Harrow, drag and roll	3.24	....	3.74	....	2.49	.14	.39	....	1.29	.02
8. Off bar operations	11.32	....	10.84	....	12.18	.21	10.98	.19	11.20	.16
9. Hoe	....	....	....	....	....	....	....	....	....	....
10. Fertilize	....	....	....	....	....	....	.25	....	.16	....
11. Cultivate mold	19.34	....	23.62	....	21.70	.82	15.47	.28	17.61	.33
12. Cultivate sulky	5.25	....	9.83	....	9.86	....	10.86	....	10.19	....
13. Knife middles	....	....	....	....	....	....	....	....	....	....
14. Water boy	....	....	....	....	.75	....	1.82	....	1.33	....
15. Other operations	.52	....	.07	....	.52	....	....	....	.13	....
Total	72.90	....	83.61	....	88.82	1.97	82.02	.83	82.68	.88
Acres	128.92	....	186.32	....	303.78	....	1,206.84	....	1,825.86	....

TABLE 20—MAN LABOR REQUIREMENTS OF 1 ACRE OF STUBBBLE CANE PRIOR TO HARVEST, LOUISIANA, 1929

Operations	Farms of 100 Crop Acres or Less	Farms of 101 to 200 Crop Acres	Farms of 201 to 300 Crop Acres	Farms of More than 300 Crop Acres	Average of All Farms
	Man Hours	Man Hours	Man Hours	Man Hours	Man Hours
1. Main drains and ditches	3.38	3.08	4.21	4.27	4.03
2. Quarter drains	6.07	4.15	7.21	5.87	5.94
3. Burn trash	.01	.04	.09	.03	.05
4. Off bar operations	3.76	6.23	6.61	4.27	4.97
5. Shave	1.11	1.24	1.54	2.15	1.83
6. Dig	1.07	.70	.49	.48	.55
7. Hoe	13.12	14.88	15.76	16.82	16.08
8. Fertilize	.43	.46	1.15	.59	.67
9. Cultivate mold	8.66	9.70	11.03	6.93	8.27
10. Cultivate sulky	5.27	4.38	6.59	4.26	4.84
11. Harrow, drag and roll	.36	.59	.40	.24	.33
12. Knife middles	1.42	2.38	1.22	....	.68
13. Water boy	....	.88	2.26	1.31	1.35
Total Man Labor	44.66	48.71	58.56	47.22	49.59
Acres	374.16	689.48	1,085.36	3,070.80	5,219.80

TABLE 21—POWER REQUIREMENTS OF 1 ACRE OF STUBBLE CANE PRIOR TO HARVEST, LOUISIANA, 1929

Operations	Farms of 100 Crop Acres or Less		Farms of 101 to 200 Crop Acres		Farms of 201 to 300 Crop Acres		Farms of More than 300 Crop Acres		Average of All Farms	
	Mule Hours	Tr. Hours	Mule Hours	Tr. Hours	Mule Hours	Tr. Hours	Mule Hours	Tr. Hours	Mule Hours	Tr. Hours
1. Main drains and ditches	....	....	....	....	.88	....	....	....	.18	....
2. Quarter drains	2.64	....	2.88	....	2.15	....	2.73	....	2.62	....
3. Burn trash	....	....	....	....	....	....	....	....	....	....
4. Off bar operations	7.54	....	12.43	....	12.82	.09	8.37	.06	9.78	.06
5. Shave	2.65	....	3.17	....	3.95	....	4.46	....	4.05	....
6. Dig	2.13	....	1.39	....	.99	....	.96	....	1.12	....
7. Hoe	....	....	....	....	....	....	....	....	....	....
8. Fertilize	.59	....	.62	....	1.04	....	1.06	....	.96	....
9. Cultivate mold	16.64	....	20.42	....	21.15	.46	12.75	.57	15.79	.43
10. Cultivate sulky	10.13	....	8.76	....	13.16	....	8.46	.09	9.59	.05
11. Harrow, drag and roll	.73	....	1.18	....	.80	....	.12	....	.45	....
12. Knife middles	....	....	....	....	....	....	....	....	....	....
13. Water boy	....	....	.89	....	2.31	....	1.30	....	1.36	....
Total	43.05	....	51.74	....	59.25	.55	40.21	.72	45.90	.54
Acres	374.16	....	689.48	....	1,085.36	....	3,070.80	....	5,219.80	....

TABLE 22—MAN LABOR AND POWER REQUIREMENTS FOR HARVESTING CANE ON 74 LOUISIANA FARMS IN 1929

	Farms of 100 Crop Acres or Less	Farms of 101 to 200 Crop Acres	Farms of 201 to 300 Crop Acres	Farms of More than 300 Crop Acres
Cut and Strip Standing Cane:				
Man Hours per Acre....	85.9	97.2	97.3	87.4
Man Hours per Ton.....	4.71	5.78	5.98	5.05
Cut and Windrow Cane:				
Man Hours per Acre....	....	30.3	33.6	37.1
Strip from Windrow:				
Man Hours per Acre....	....	89.0	86.1	83.7
Man Hours per Ton.....	....	4.77	6.26	4.64
Load and Haul:				
Man Hours per Acre....	26.9	24.1	25.9	25.6
Mule Hours per Acre...	52.9	57.5	56.2	55.2
Man Hours per Ton.....	1.49	1.43	1.58	1.47
Mule Hours per Ton....	2.92	3.41	3.28	3.18

TABLE 23—MAN LABOR REQUIREMENTS ON 1 ACRE OF CORN, SUGAR CANE AREA, 1929

Operations	Farms of 100 Crop Acres or Less	Farms of 101 to 200 Crop Acres	Farms of 201 to 300 Crop Acres	Farms of More than 300 Crop Acres	Average of All Farms
	Man Hours	Man Hours	Man Hours	Man Hours	Man Hours
1. Main drains and ditches	3.06	2.73	2.05	2.51	2.50
2. Quarter drains	5.35	3.58	4.42	4.80	4.51
3. Land preparation	9.29	9.19	9.76	8.43	8.95
4. Planting	2.31	1.93	1.47	1.87	1.82
5. Harrow, drag and roll	.97	.50	.58	.28	.45
6. Off bar operations	1.39	.65	.76	.06	.45
7. Fertilize	....	....	....	.18	.09
8. Cultivate mold	4.96	3.74	5.28	4.02	4.33
9. Cultivate sulky	2.87	3.45	3.94	2.92	3.25
10. Hoe	3.24	2.06	3.05	.89	1.83
11. Water boy	....	.14	.44	.75	.49
Total Production	33.44	27.97	31.75	26.71	28.67
12. Bend	.58	.50	.09	.18	.26
13. Cut and Haul Tops	.46	.09	....	.77	.43
14. Break and Haul Corn	8.69	7.04	9.27	6.58	7.46
Total Harvesting	9.73	7.63	9.36	7.53	8.15
Total Requirements	43.17	35.60	41.11	34.24	36.82
Acres	624.39	1,401.72	1,644.02	3,485.44	7,155.57

TABLE 24—POWER REQUIREMENTS ON 1 ACRE OF CORN, SUGAR CANE AREA, 1929

Operations	Farms of 100 Crop Acres or Less		Farms of 101 to 200 Crop Acres		Farms of 201 to 300 Crop Acres		Farms of More than 300 Crop Acres		Average of All Farms	
	Mule Hours	Tr. Hours	Mule Hours	Tr. Hours	Mule Hours	Tr. Hours	Mule Hours	Tr. Hours	Mule Hours	Tr. Hours
1. Main drains and ditches	....	....	....	....	....	....	.14	....	.07	....
2. Quarter drains	2.60	....	1.67	....	1.77	....	1.49	....	1.69	....
3. Land preparation	19.62	....	20.00	.04	19.65	.18	16.38	.33	18.10	.21
4. Planting	2.67	....	2.72	....	2.41	....	2.29	....	2.42	....
5. Harrow, drag and roll	1.95	....	.98	....	1.16	....	.56	....	.90	....
6. Off bar operations	2.77	....	1.31	....	1.52	....	....	.06	.84	.03
7. Fertilize	....	....	....	....	....	....	.35	....	.17	....
8. Cultivate mold	9.81	....	7.84	....	10.18	.12	7.88	.14	8.56	.09
9. Cultivate sulky	5.74	....	7.08	....	8.12	....	5.88	....	6.62	....
10. Hoe	....	....	....	....	....	....	....	....	....	....
11. Water boy	....	....	.14	....	.44	....	.74	....	.49	....
Total Production	45.16	....	41.74	.04	45.25	.30	35.71	.53	39.86	.33
12. Bend	....	....	....	....	....	....	....	....	....	....
13. Cut and haul tops	.45	....	.26	....	....	....	....	....	.09	....
14. Break and haul corn	8.08	....	6.82	....	7.38	....	4.82	....	6.08	....
Total Harvesting	8.53	....	7.08	....	7.38	....	4.82	....	6.17	....
Total Requirements	53.69	....	48.82	.04	52.63	.30	40.53	.53	46.03	.33
Acres	624.39	....	1,401.72	....	1,644.02	....	3,485.44	....	7,155.57	....

TABLE 25—MAN LABOR REQUIREMENTS ON 1 ACRE OF COTTON, SUGAR CANE AREA, 1929

Operations	Farms of 100 Crop Acres or Less	Farms of 101 to 200 Crop Acres	Farms of 201 to 300 Crop Acres	Farms of More than 300 Crop Acres	Average of All Farms
	Man Hours	Man Hours	Man Hours	Man Hours	Man Hours
1. Main drains and ditches........	3.06	1.40	1.55	.42	1.50
2. Quarter drains	4.53	5.26	9.25	4.44	6.69
3. Land preparation	12.34	9.88	12.07	6.60	10.51
4. Plant and fertilize	1.61	2.02	4.25	.77	2.66
5. Harrow, drag and roll	1.19	.82	1.98	....	1.21
6. Off bar operations	1.76	2.11	1.56	1.78	1.77
7. Cultivate mold	4.04	4.70	3.49	4.22	3.99
8. Cultivate sulky	2.29	3.64	7.28	4.82	5.24
9. Hoe	17.75	25.72	20.47	29.58	23.14
10. Dust	....	.10	.99	....	.44
11. Water boy	....	....	3.39	.67	1.58
Total Production	48.57	55.65	66.28	53.30	58.73
12. Picking	38.74	57.47	83.01	35.10	61.31
13. Weighing and hauling.........	1.86	.91	2.29	.76	1.60
Total Harvesting	40.60	58.38	85.30	35.86	62.91
Total Requirements	89.17	114.03	151.58	89.16	121.64
Acres	82.64	141.05	253.46	118.00	595.15

TABLE 26—POWER REQUIREMENTS ON 1 ACRE OF COTTON, SUGAR CANE AREA, 1929

Operations	Farms of 100 Crop Acres or Less		Farms of 101 to 200 Crop Acres		Farms of 201 to 300 Crop Acres		Farms of More than 300 Crop Acres		Average of All Farms	
	Mule Hours	Tr. Hours	Mule Hours	Tr. Hours	Mule Hours	Tr. Hours	Mule Hours	Tr. Hours	Mule Hours	Tr. Hours
1. Main drains and ditches	....	....	....	....	....	....	....	....	....	....
2. Quarter drains	2.75	....	3.48	....	3.23	....	1.17	....	2.82	....
3. Land preparation	25.41	....	19.12	....	24.02	.57	10.37	.88	20.35	.42
4. Plant and fertilize	2.09	....	2.89	....	8.06	....	1.53	....	4.71	....
5. Harrow, drag and roll	2.39	....	1.37	....	3.96	....	....	....	2.35	....
6. Off bar operations	3.51	....	4.23	....	3.12	....	3.56	....	3.52	....
7. Cultivate mold	8.09	....	9.41	....	6.97	....	8.42	....	7.99	....
8. Cultivate sulky	4.59	....	7.28	....	14.56	....	9.66	....	10.48	....
9. Hoe	....	....	....	....	....	....	....	....	....	....
10. Dust	....	....	.14	....	....	....	....	....	.03	....
11. Water boy	....	....	....	....	3.39	....	.67	....	1.58	....
Total Production	48.83	....	47.92	....	67.31	.57	35.38	.88	53.83	.42
12. Picking	....	....	....	....	....	....	....	....	....	....
13. Weighing and hauling	3.72	....	1.67	....	.46	1.08*	.26	.12*	1.15	.48*
Total Harvesting	3.72	....	1.67	....	.46	1.08*	.26	.12*	1.15	.48*
Total Requirements	52.55	....	49.59	....	67.77	.57	35.64	.88*	54.98	.42*
	....	....	....	....	....	.08*	....	.12*	....	.48*
Acres	82.64	....	141.05	....	253.46	....	118.00	....	595.15	....

*Truck Hours.

TABLE 27—MAN LABOR REQUIREMENTS ON 1 ACRE OF SWEET POTATOES, SUGAR CANE AREA, 1929

Operations	Farms of 100 Crop Acres or Less	Farms of 101 to 200 Crop Acres	Farms of 201 to 300 Crop Acres	Farms of More than 300 Crop Acres	Average of All Farms
	Man Hours	Man Hours	Man Hours	Man Hours	Man Hours
1. Main drains and ditches........	.38	....	....	.45	.23
2. Quarter drains	3.29	3.68	2.85	1.27	2.54
3. Growing plants	4.59	4.86	5.09	3.06	4.20
4. Land preparation	12.47	10.22	7.00	6.54	8.52
5. Planting	14.90	10.75	25.01	15.34	16.44
6. Hoe	4.43	....	1.70	....	1.15
7. Off bar operations	.82	....	.40	.27	.34
8. Cultivate mold	2.30	2.23	2.50	1.36	1.99
9. Cultivate sulky	1.74	1.86	.99	3.08	2.09
10. Harrow, drag and roll	....	.07	.15	....	.05
Total Production	44.92	33.67	45.69	31.37	37.55
11. Harvest and store.............	29.49	12.51	27.51	17.09	20.57
Total Requirements	74.41	46.18	73.20	48.46	58.12
Acres	25.77	35.00	35.14	55.00	150.91

TABLE 28—POWER REQUIREMENTS ON 1 ACRE OF SWEET POTATOES, SUGAR CANE AREA, 1929

Operations	Farms of 100 Crop Acres or Less		Farms of 101 to 200 Crop Acres		Farms of 201 to 300 Crop Acres		Farms of More than 300 Crop Acres		Average of All Farms	
	Mule Hours	Tr. Hours	Mule Hours	Tr. Hours	Mule Hours	Tr. Hours	Mule Hours	Tr. Hours	Mule Hours	Tr. Hours
1. Main drains and ditches	....	....	....	....	....	....	....	....	....	....
2. Quarter drains	3.10	....	2.40	....	2.85	....	.36	....	1.88	....
3. Growing plants	1.57	....	1.48	....	5.30	....	2.26	....	2.67	....
4. Land preparation	25.55	....	20.44	....	14.85	....	10.06	.94	16.23	.34
5. Planting	....	....	.57	....	4.48	....	1.46	....	1.71	....
6. Hoe	....	....	....	....	....	....	....	....	....	....
7. Off bar operations	1.64	....	....	....	.81	....	.54	....	.66	....
8. Cultivate mold	4.62	....	4.46	....	5.00	....	2.73	....	3.98	....
9. Cultivate sulky	3.45	....	3.73	....	1.99	....	6.16	....	4.15	....
10. Harrow, drag and roll	....	....	.14	....	.31	....	....	....	.12	....
Total Production	39.93	....	33.22	....	35.59	....	23.57	.94	31.40	34.
11. Harvest and store	14.87	....	8.35	....	13.30	.17*	2.19	.64	8.37	.23 .04*
Total Requirements	54.80	....	41.57	....	48.89	.17*	25.76	1.58	39.77	.57 .04*
Acres	25.77	....	35.00	....	35.14	....	55.00	....	150.91	....

*Truck Hours.

TABLE 29—MAN LABOR REQUIREMENTS PER ACRE FOR HARVESTING SOYBEANS AND PEAS (IN CORN), SUGAR CANE AREA, 1929

Operations	Farms of 100 Crop Acres or Less	Farms of 101 to 200 Crop Acres	Farms of 201 to 300 Crop Acres	Farms of More than 300 Crop Acres	Average of All Farms
	Man Hours	Man Hours	Man Hours	Man Hours	Man Hours
Soybeans and Peas (in corn):					
1. Mowing	2.54	1.35	1.69	5.13	3.31
2. Raking	1.97	1.88	1.87	.89	1.37
3. Spreading	3.97	3.83	1.48	3.01	2.96
4. Shock	1.11	....	1.04	....	.56
5. Load, haul and store	8.21	7.55	5.55	5.03	5.94
Total	17.80	14.61	11.63	14.06	14.14
Total Acres	282.43	398.32	815.50	1,010.00	2,506.25
Acres Harvested	177.34	228.80	276.34	740.00	1,422.48

TABLE 30—POWER REQUIREMENTS PER ACRE FOR HARVESTING SOYBEANS AND PEAS (IN CORN), SUGAR CANE AREA, 1929

Operations	Farms of 100 Crop Acres or Less	Farms of 101 to 200 Crop Acres	Farms of 201 to 300 Crop Acres	Farms of More than 300 Crop Acres	Average of All Farms
	Mule Hours	Mule Hours	Mule Hours	Mule Hours	Mule Hours
Soybeans and Peas (in corn):					
1. Mowing	....	....	....	....	....
2. Raking	3.94	3.76	3.75	.88	2.28
3. Spreading	....	2.89	....	....	.46
4. Shock	....	....	....	....	....
5. Load, haul and store	5.67	5.19	4.40	5.70	5.36
Total	9.61.	11.84	8.15	6.58	8.10
Total Acres	282.43	398.32	815.50	1,010.00	2,506.25
Acres Harvested	177.34	228.80	276.34	740.00	1,422.48

TABLE 31—MAN LABOR REQUIREMENTS PER ACRE FOR HARVESTING ALFALFA, SUGAR CANE AREA, 1929

Operations	Farms of 100 Crop Acres or Less	Farms of 101 to 200 Crop Acres	Farms of 201 to 300 Crop Acres	Farms of More than 300 Crop Acres	Average of All Farms
	Man Hours	Man Hours	Man Hours	Man Hours	Man Hours
Alfalfa:					
1. Mowing	....	4.84	....	8.16	7.59
2. Raking	....	2.13	....	4.08	3.74
3. Spreading	....	....	....	....	....
4. Shock	....	1.94	....	....	.34
5. Load, haul and store	....	9.69	....	36.73	32.02
Total	....	18.60	....	48.97	43.69
Acres	....	10.32	....	49.00	59.32

TABLE 32—POWER REQUIREMENTS PER ACRE FOR HARVESTING ALFALFA, SUGAR CANE AREA, 1929

Operations	Farms of 100 Crop Acres or Less	Farms of 101 to 200 Crop Acres	Farms of 201 to 300 Crop Acres	Farms of More than 300 Crop Acres	Average of All Farms
	Mule Hours	Mule Hours	Mule Hours	Mule Hours	Mule Hours
Alfalfa:					
1. Mowing	....	9.69	....	16.33	15.17
2. Raking	....	4.26	....	5.31	5.13
3. Spreading	....	....	....	....	....
4. Shock	....	....	....	....	....
5. Load, haul and store	....	7.75	....	24.49	21.57
Total	....	21.70	....	46.13	41.87
Acres	....	10.32	....	49.00	59.32

TABLE 33—MAN LABOR REQUIREMENTS PER ACRE FOR HARVESTING LESPEDEZA AND WILD HAYS, SUGAR CANE AREA, 1929

Operations	Farms of 100 Crop Acres or Less	Farms of 101 to 200 Crop Acres	Farms of 201 to 300 Crop Acres	Farms of More than 300 Crop Acres	Average of All Farms
	Man Hours	Man Hours	Man Hours	Man Hours	Man Hours
Lespedeza and Wild Hays:					
1. Mowing	9.92	1.90	2.66	2.73	2.98
2. Raking	2.54	1.08	1.46	4.67	2.53
3. Spreading	.24	....	....	....	....
4. Shock	....	.43	....	3.63	1.33
5. Load, haul and store	12.94	7.33	12.11	12.46	11.07
Total	25.64	10.74	16.23	23.49	17.91
Acres	37.00	141.75	190.04	188.00	556.79

TABLE 34—POWER REQUIREMENTS PER ACRE FOR HARVESTING LESPEDEZA AND WILD HAYS, SUGAR CANE AREA, 1929

Operations	Farms of 100 Crop Acres or Less	Farms of 101 to 200 Crop Acres	Farms of 201 to 300 Crop Acres	Farms of More than 300 Crop Acres	Average of All Farms
	Mule Hours	Mule Hours	Mule Hours	Mule Hours	Mule Hours
Lespedeza and Wild Hays:					
1. Mowing	15.41	3.80	5.33	5.47	5.65
2. Raking	3.62	1.66	2.22	1.56	1.95
3. Spreading	....	....	....	....	....
4. Shock	....	....	....	4.14	1.41
5. Load, haul and store	13.70	5.60	10.89	8.58	8.95
Total	32.73	11.06	18.44	19.75	17.96
Acres	37.00	141.75	190.04	188.00	556.79

TABLE 35—DISTRIBUTION OF CROP ACREAGE ACCORDING TO SIZE OF FARM, SUGAR CANE AREA, 1929

Crops	Farms of 100 Crop Acres or Less	Farms of 101 to 200 Crop Acres	Farms of 201 to 300 Crop Acres	Farms of More than 300 Crop Acres
	Acres Per Farm	Acres Per Farm	Acres Per Farm	Acres Per Farm
Fall Plant Cane.....	14.26	29.36	52.32	150.98
Spring Plant Cane..	7.16	8.87	16.88	70.99
Stubble Cane	20.79	33.16	60.30	180.64
Total Cane . ..	42.21	71.39	129.50	402.61
Corn	34.69	66.75	91.33	205.03
Soybeans and Peas (in corn)	(34.02)	(56.98)	(89.17)	(198.56)
Cotton	4.59	6.72	14.07	6.94
Soybeans and Peas..	....	1.43	6.89	13.24
Sweet Potatoes	1.88	2.19	1.92	4.23
White Potatoes	1.42	.64	.90	....
Truck Crops	.97	.61	.87	.24
Other Cultivated Cr.	....	3.52	....	11.76
Total Cul. Crops	85.76	153.25	245.48	644.05
Seeded Hay Crops..	.83	1.75	1.28	6.18
Tillable Pasture . ..	2.12	5.28	9.67	13.69
Total Til'ble Ld.	88.71	160.28	256.43	663.92
No. of Farms	18	21	18	17

TABLE 36—SEED CANE, MILL CANE, AND CANE LOSSES ON 74 LOUISIANA SUGAR CANE FARMS, 1929

	Farms of 100 Crop Acres or Less	Farms of 101 to 200 Crop Acres	Farms of 201 to 300 Crop Acres	Farms of More than 300 Crop Acres
	Acres	Acres	Acres	Acres
Seed	48.66	68.82	128.61	312.26
Left Standing	....	36.92	103.00	377.00
Left in Windrow	2.64	14.78	60.28	82.00
Cut and Stripped for Mill	686.52	1,348.40	1,764.39	5,391.26
Cut and Windrowed	(24.58)	(53.98)	(334.86)	(763.88)
Strip from Windrow	21.94	39.20	274.58	681.88
Total	759.76	1,508.12	2,330.86	6,844.40
No. of Farms	18	21	18	17

TABLE 37—NUMBER OF HEAD OF LIVESTOCK BY CLASSES ACCORDING TO SIZE OF FARM, SUGAR CANE AREA, 1929

	Farms of 100 Crop Acres or Less	Farms of 101 to 200 Crop Acres	Farms of 201 to 300 Crop Acres	Farms of More than 300 Crop Acres
	Number	Number	Number	Number
Workstock:				
Work Mules	5.75	8.60	14.75	35.58
Pensioners	.06	.24	....	.16
Saddle Stock	.28	.48	1.06	1.24
Others	.05	.28	.38	.12
Total Workstock	6.14	9.60	16.19	37.10
Other Livestock:				
Beef Cattle	.11	4.33	2.89	4.88
Milk Cows	3.11	2.90	3.50	5.35
Young Cattle	2.33	3.48	.61	4.23
Hogs	6.39	15.33	11.26	15.41
Sheep	....	1.81	1.50	2.59
Total Other Livestock	11.94	27.85	19.76	32.46
Total Livestock:	18.08	37.45	35.95	69.56

TABLE 38—ANNUAL FEED CONSUMPTION PER MULE ON NON-TRACTOR FARMS IN THE SUGAR CANE AREA, 1929

Feeds	Farms of 100 Crop Acres or Less	Farms of 101 to 200 Crop Acres	Farms of 201 to 300 Crop Acres	Farms of More than 300 Crop Acres
	Pounds	Pounds	Pounds	Pounds
Concentrates:				
Ear Corn	8,726	8,148	6,519	5,691
Ground Corn	....	....	325	1,551
Oats (ground) . ..	....	....	....	831
Molasses	16	83	515	2,325
Mixed Feeds	205	178	635	....
Total Concents.	8,947	8,409	7,994	10,398
Hays:				
Soybean Hay	3,614	3,989	4,924	4,887
Alfalfa Hay	....	529	....	277
Lespedeza Hay ..	163	....	47	346
Wild Hay	1,085	719	973	1,100
Total Hay	4,862	5,237	5,944	6,610
Low Grade Rough...	613	833	148	554
Av. Feed per Day:				
Concentrates	24.5	23.0	21.9	28.5
Hay	13.3	14.4	16.3	18.1
Other Roughages..	1.7	2.3	.4	1.5

TABLE 39—TOTAL AND DAILY FEED CONSUMPTION PER MULE ON TRACTOR AND NON-TRACTOR FARMS OF MORE THAN 300 CROP ACRES, SUGAR CANE AREA, 1929

Feeds	Tractor Farms	Non-Tractor Farms
	Pounds	Pounds
Concentrates:		
Ear Corn	....	5,691
Ground Corn	6,556	1,551
Oats (ground)	....	831
Molasses	577	2,325
Mixed Feeds	520	....
Total Concentrates	7,653	10,398
Hays:		
Soybean Hay	4,757	4,887
Alfalfa Hay	761	277
Lespedeza Hay	....	346
Wild Hay	146	1,100
Total Hay	5,664	6,610
Low Grade Roughages	314	554
Average Feed per Day:		
Concentrates	20.9	28.5
Hay	15.5	18.1
Other Roughages	1.0	1.5

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RICE FARM IRRIGATION SYSTEMS IN LOUISIANA, 1929

BY

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RICE FARM IRRIGATION SYSTEMS IN LOUISIANA, 1929

by

R. J. SAVILLE, Associate Economist

Rice growing in Louisiana is dependent entirely upon artificial irrigation methods. The farmer may use either surface or deep well water. The surface water is obtained from bayous, streams, or drainage ditches, and is furnished chiefly by commercial irrigation companies. The deep well water is pumped from wells about three hundred or four hundred feet deep. These are operated almost entirely by individual farmers or a small group of farmers in partnership. Both the commercial irrigation companies and the individual farmers use Diesel engines, steam engines, or electric motors as the source of power with which to lift the water to the level of the rice land. Some canal companies install relifts out from the main intake at the bayou in order to extend their flooding area. The lift under such conditions is about eight or ten feet. The main lift at the bayou may be forty to sixty-five feet. The farmers operating from bayous, streams, or ditches have a similar lift, but require a different size of unit. Lifts from deep wells may vary widely due to drought, and to the volume of water necessary to handle the rice area being flooded.

Commercial irrigation companies are able to secure a large volume of business, an opportune condition for desirable adjustments. However, the dangers of salt water from the bayous and topographical difficulties have limited the extent of canal expansion at present rental rates. Salt water occurred in 1924 and 1925. This condition results from over-pumping the fresh water from the bayou, so that salt water flows inland from the coast as far as the pumping plants. The salty condition of the water not only destroys the growing rice crop, if allowed to flow on it, but also may leave an undesirable technological condition of the soil, even after fresh water is applied on later crops of rice.

The irrigation companies and the farmers using canal water share heavily in the loss when salt water appears, for the companies usually take a share of the crop as water rent. In some instances, to be sure, the risk is shifted in advance when the farmer pays a cash rent per acre for canal water. Farmers operating under deep wells gain materially in salt water years. While their pumping requirements are advanced because of the lack of rainfall, the price of rice reacts more favorably for those securing the better yields. Thus investments in deep well irrigation reach a high level immediately after salt water occurs. The original purchase dates of Diesel engines now in use indicate installation following salt water years.

AN EXPLANATION OF TERMS

This report presupposes a general knowledge of rice farming on the part of the reader. In order to clarify the terms used, however, some explanation may be given. Yields are quoted in bags per acre, a bag of rice being two hundred pounds in the rough. A barrel of rough rice is one hundred sixty-two pounds. All price quotations for rice are on the basis of dollars per barrel of rough rice. Size of farm as used in this report refers to the acres of rice handled by each operator. Labor income refers to the return which the operator gets for his efforts as an item separate from investment. In this study labor income has been calculated on the basis of a charge of two-fifths of the rice crop for land and water rent and one-fourth of the other crops for land rent. The other items consist of actual cash expenses and inventory decreases, and cash incomes and inventory increases. The method used was considered more appropriate in this study because current rentals are decidedly more frequent than are real estate transfers. Farmers think in terms of these rentals as the alternative rather than capitalized value of their investments. Also, deep wells on farms tend to influence land value itself, and the attempt to separate investment in pumping plants from that of the real estate introduces more error than using a current competitive rental basis. Operating outlay refers to expenditures for fuel and oil, insurance, repair, and labor. Overhead outlay refers to charges for depreciation and interest foregone in the use of the article.

TYPES OF IRRIGATION UNITS

A number of different types of irrigation units were found. They consisted of the following: (1) One cylinder Diesel engines, fifty to one hundred horsepower; (2) two cylinder Diesel engines, one hundred to one hundred twenty-five horse-power; (3) steam engines, not rated; (4) electric motors, vertical and horizontal, forty to one hundred horse-power; (5) tractor relifts. The Diesel engine is an internal combustion engine usually having a horizontal piston movement. The crude oil fuel is forced into the combustion chamber under high pressure and is ignited from a heated plug. The use of steam plants is a thing of the past in rice farming and needs no discussion here. They only survive because of service yet unused and the opportunity which they offer for the utilization of farm labor which, otherwise employed, would add less to the farm income. The chief problem of irrigation centers around the use of Diesel engines and electric motors. Outlays for irrigation purposes on farms using canal water are presented merely for comparative purposes. The data on competitive canal rentals may prove helpful, if one is considering changing from a present system of irrigation to some other.

The sources of irrigation water on the rice farms studied are given in Table I. The fact that poor adjustment has frequently resulted from the installation of a Diesel engine is indicated by the practice of flooding outside crop land in order to get the engine used at optimum capacity. For a rice farmer to have high cost merely means he has a poor adjustment in his outlays, whether fixed or operating, between the irrigation plant and the land which he has to be irrigated.

TABLE I.

SOURCES OF IRRIGATION WATER ON RICE FARMS STUDIED, ACADIA AND JEFFERSON DAVIS PARISHES, 1929.

Source of Water	How Secured*	Number of Farms		
		Acadia Parish	Jeff. Davis Parish	Total
Surface	Water Rental	32	15	47
Deep Well	Water Rental	11	3	14
Deep Well	Diesel Engine	17	24	41
Deep Well	Electric Motor	1	15	16
Deep Well	Steam Engine	0	2	2
Deep Well	Diesel Engine Electric Motor	1	0	1
Surface	Electric Motor	0	1	1
Surface	Tractor Relift	2	0	2
Total		64	60	124

*Refers to dominant source.

Some farmers have small areas in rice which are too high to be flooded satisfactorily unless the water is relifted. Tractors are used for this very satisfactorily. The relift is usually small and will not require steady running of the tractor for more than a day or two at a time. Frequently the tractor may be throttled down and little attention other than supplying fuel and oil is required. A few farmers use tractors even more intensively for relifting purposes. The practice does not add much to the total outlay for irrigation purposes when the area of rice so handled is small, yet to use tractor power for relifting when a large area is concerned does not appear to be desirable from a financial standpoint.

THE 1929 IRRIGATION SEASON

Rice yields and prices were extremely favorable for the Louisiana producers in 1929. A relatively short United States rice crop and a large Louisiana crop added much to the farm income from rice. Past experience in the area indicates an increased activity in power machinery replacement after such favorable periods. Similar conditions occurred in 1924 and 1925, and at the close of the high price peak in 1919-20. Farmers should not plan their activities with the idea that conditions like those of 1929 will repeat themselves. Possibly they may, but probably not.

Precipitation in the rice area in 1929 was favorable for low irrigation outlays. Farmers operating under the canals fail to get advantages of timely precipitation. If high yields result the canal company shares in it, as well as in the losses when low yields are secured. The deep well operators obtained all the advantages of a good crop year with low irrigation outlays in 1929. No doubt their incomes were slightly larger than those of farmers on similar sized farms paying a share water rental.

Being able to take advantage of precipitation may effect appreciable differences in current irrigation outlays. This factor is influenced by the amount and time of precipitation. A farmer may flood during the week only to get a two or three inch rain, the benefit of which will be lost. In fact it may cause him to lose water already pumped if the levees are overflowed and broken, or may actually injure his crop. This condition is particularly true on land where new levees have been constructed. When the water level remains high during the season, pumping outlays may be reduced over what would be necessary if lifting had to be done from a low level. A power unit must also be large enough to meet peak requirements and may appear excessive during a favorable pumping year. The monthly distribution of the precipitation in 1929 and a comparison of it with the previous ten-year period are presented for the usual pumping season in Table II.

TABLE II.

AVERAGE MONTHLY PRECIPITATION AND TEMPERATURE AT JENNINGS, LOUISIANA, FOR 1929, WITH COMPARISON FOR THE TEN-YEAR AVERAGE, 1919-1928.

Month	Precipitation 1919-28	1929	Inches Difference	Temperature 1919-28	1929	Degrees Difference
April	4.28	1.71	—2.57	68.4	72.2	+3.8
May	5.00	8.48	+3.48	73.9	74.6	+0.7
June	5.09	5.90	+0.81	80.8	80.3	—0.5
July	5.44	4.36	—1.08	82.1	81.8	—0.3
August	4.49	3.04	—1.45	82.8	82.8	0.0

Source of Data. Climatological Data for Louisiana.

YIELDS PER ACRE AND SOURCE OF WATER

The farmer recognizes the phenomenon that all factors combine to influence yields. Sometimes one factor exerts more influence than at other times when apparently similar conditions prevailed. Likewise, he is aware that no particular factor contributes specific amounts toward increased yields independently of some contribution from other factors, though he may never willingly change those other factors. All factors are present and important in getting high yields. The question is frequently placed whether higher yields are obtained under deep well irrigation or under surface water. A tabulation considering all varieties was made of the farms studied. This indicated only two-tenths of a bag difference in favor of the deep well farms. After eliminating farms using two sources of water and those uncertain about varieties grown, a classification was made, by varieties, showing yields under the different sources of water (Table III). If soils, fertilizer practices, seed conditions, and land preparation were equally determinant on all farms included, the differences seem insignificant. The writer believes that the deep well farms have slightly better soils on the average than prevailed on farms using surface water.

TABLE III.

YIELD PER ACRE UNDER DIFFERENT SYSTEMS OF WATER SOURCE, BY VARIETIES OF RICE, ACADIA AND JEFFERSON DAVIS PARISHES, 1929.

Variety	Surface Water— Number of Farms	Yield, Bags	—Deep Well Water— Number of Farms	Yield, Bags
Early Prolific	14	11.1	22	10.9
Fortuna	11	10.8	21	12.2
Greater Improved Blue Rose	10	10.8	21	11.1
Old Blue Rose	24	10.5	16	11.1
Supreme Blue Rose	12	9.4	26	9.7

MAJOR PROBLEMS IN PUMPING POWER

The choice between using surface water and deep well water is only one of the irrigation problems. Farmers in many areas have no access to surface water and must depend upon deep wells if they are to stay in the business. Other farmers do not have electrical power available at their places at present. To these farmers, operating with Diesel engines is their only choice. Their problem is merely one of efficient adjustment of acreage flooded to the size of the pumping unit. Most of the areas where deep wells are used, have access to electrical power or will have in the near future. Farmers under these conditions have the problem of choice between Diesel engines or electric motors. This condition is the outstanding situation to be considered in connection with irrigation. The fundamental problem, then, is one of choice of time when the present Diesel engine should be discarded and an electric motor installed. Factors effecting these changes and adjustments will be taken up in the discussion of types of irrigation systems.

DATA AND APPLICATION

A study of irrigation systems in use on a number of rice farms, was conducted in the winter of 1929, in order to secure definite information under actual conditions of operation. The data were for the current crop year, and were secured by interviews with one hundred twenty-four rice farmers located in Wards Three, Four, and Six of Jefferson Davis and Acadia Parishes. It is not contended that the data secured are typical of the entire Southwestern Louisiana rice area, as wide variations occur in types of soil, water level, acres of rice per farm, and type of rice farmer. Again, it is necessary for the farmer to consider changes which have occurred since 1929, such as wages, fuel and oil prices, electrical current rates, and the expected price of rice. It is believed, however, that the conditions found will apply generally to the farms in the area where similar types of organization prevail.

INVESTMENT REQUIREMENTS

The installation of a pumping outfit tends to increase investment requirements fifteen to twenty-five per cent. Some adjustment is possible in the size of engine or motor used, in the pump, and in digging the well. Usually well construction and pump vary but little in outlay. Thus on the smaller unit the investment becomes top heavy unless more acres can be secured outside to help carry the overhead. Diesel engines were reported as costing about $100 per horse-power. Electric motors may be secured in the range of $700 to $1,600. To have a well dug will cost about $2,500, and the installation of a ten or twelve-inch pump will require about $1,500 additional.

Outlays for the installation of well and pump are partly reflected in the price of land. As a business proposition much land would temporarily be worthless for rice production without a well. Many of these areas cannot be reached by canals, due to topography. An estimate of total investment and the per cent of investment in the pumping outfit are presented in Table IV.

OUTLAYS AND ACCOMPLISHMENTS

Unit requirement data for an area flooded are presented to show some of the variations existing and the amounts which should be provided in budgeting for purposes of organization changes. These data apply to farms using canal water as well as individual pumping plants. The operating outlays for the individual pumping plants are believed to be quite accurate and indicate economies actually secured in 1929, whether voluntary or accidental. The items of overhead outlays should not be over-emphasized for they contain items extremely difficult to determine. The data presented represent what farmers using the plants estimate to be the chargeable depreciation and interest foregone in the plant. In nearly every instance marked increases in acres flooded are associated with lower acre outlays for overhead. More explanation will be given on these points in the discussion which follows.

TABLE IV.

PER CENT OF THE AVERAGE FARM INVESTMENT EMPLOYED IN THE PUMPING OUTFIT, ACADIA AND JEFFERSON DAVIS PARISHES, 1929.

Acres of Rice per Farm	Number of Farms	Average Investment per Farm	Investment In Pumping Outfit	Per Cent In Pumping Outfit
0-100	2	$25,631	$5,250	20.5
101-200	26	28,842	4,068	14.1
201-300	14	46,517	6,562	12.0
301-over	12	59,079	6,092	10.3

WATER RENT PAYMENT

The most common rate of payment for canal water is one-fifth of the rice crop delivered in the warehouse. A few canal companies charge twenty-two per cent. Water rent is one-fifth when deep well water is used. Therefore, from the standpoint of the farmer renting water, the source is insignificant so far as the share rental is concerned. If the quality of the rice is poor, due to apparent neglect on the part of the operator, the rental may be one-fourth of the crop. This usually means that the price of the rice delivered as rent is twenty to forty cents per barrel below the price of first or second grade of the same variety. Using prices received by the farmer and the amount paid as rental by the farmer in bags, the outlay for his water rent may be determined.

A distribution of farms by acres of rice handled, and by outlay per acre of rice flooded from the canal or private well, is presented in Table V. A few farmers paid a flat rate of $6.00 per acre for canal water and took the risk of the crop. Being on the favorable side of yield and prices, they secured their water for about two-thirds of the normal outlay in 1929. The average outlay for water rental does not seem to be far from that of pumping plants. Small units gain by having canal water. The larger places lose under such a system. Even though variations of yield seem to be largely independent of water conditions, the canal companies share in the income when yields are high. On the other hand, deep well operators retain all their income.

TABLE V.

OUTLAY FOR WATER ON FARMS PAYING WATER RENT, ACADIA AND JEFFERSON DAVIS PARISHES, 1929.

Acres of Rice Flooded	Number of Farms	Average Acres of Rice	Average Yield, Bags	Gross Outlay per Farm	Outlay per Acre
0-100	20	73	10.0	$ 685	$9.31
101-200....................	19	144	11.3	1,521	10.52
201-300....................	12	244	10.6	2,307	9.46
301-over....................	9	381	9.6	3,619	9.45

DIESEL ENGINE OPERATION

Individual farm data on Diesel engines are presented in Tables VI and VII. Most of the engines reported were installed after the salt water season of 1924 and 1925, or at the close of the high price period of 1919-20. Recent installations consist of second hand engines which may be purchased for about new electric motor prices. However, the trend is for electric motors entirely. This condition is extending even to the commercial irrigation companies.

Diesel engines require supplementary equipment not needed with electric motors. An elevated tank for fuel storage must be installed. An air pressure tank and a small gasoline engine to drive the air pump are required. Sometimes a tractor is used in place of the gasoline engine. The crude oil fuel is usually pumped by hand from the truck or wagon to the elevated storage tank. More building room is required and heavy concrete foundations add considerably to the installation outlay.

The operating outlay includes the fuel and oil, replacement of parts for engine and pump, repair labor, outlay for hauling fuel, labor to attend engine during pumping season, and insurance. The overhead outlay refers to estimated depreciation and interest foregone for the season 1929. Most farmers use two men to operate a Diesel engine when pumping. Each man works twelve hours beginning at twelve o'clock noon or at midnight. This work pays about $2.00 to $2.50 per day. Hauling fuel is done with tanks holding seven and a half to eight barrels or with the regular forty gallon barrel. An engine of fifty to seventy horse-power will consume about three and a half to four barrels in twenty-four hours. The one hundred horse-power engine will consume between four and a half and six barrels. Crude oil costs from $1.65 to $1.90

per barrel undelivered. Heavy cylinder oil costs forty-five to fifty cents a gallon delivered at the farm, while light or steam engine oil is about twenty cents. But the engine is not run at maximum speed unless the need for water requires it. Under such conditions the engine may be run all season without getting up to full load. This factor was considered more technical than economic and therefore was not studied. Family labor may be well utilized by having a Diesel engine rather than an electric motor. There are several opportunities for the farmers to enhance their income by continuing the use of the Diesel engines since they are already installed and are giving satisfactory service.

TABLE VI.

OUTLAY FOR IRRIGATION ON RICE FARMS USING DIESEL ENGINE PUMPING PLANTS, JEFFERSON DAVIS PARISH, 1929.

					–Outlay per Acre–		
Farm No.	Make of Engine	Horse Power	Age	Acres Flooded	Operating	Overhead	Total
31A	Buckeye	90	10	0	Not used in 1929		
33A	Bessemer	85	5	0	Not used in 1929		
38A	Bessemer	80	....	265	$1.95	$3.80	$5.75
17A	Bessemer	85	11	200	2.30	3.00	5.30
49A	Bessemer	70	4	150	2.37	8.01	10.38
35A	Giant	100	5	182	3.09	7.51	10.60
26A	Anderson	60	4	195	3.25	4.31	7.56
4A	Bessemer	85	4	250	3.34	3.60	6.94
6A	Muncie*	100	12	330	3.43	2.75	6.18
7A	Muncie*	100	12	330	3.43	2.75	6.18
19A	Muncie†	125	10	480	3.47	2.88	6.35
24A	Muncie†	125	10	480	3.47	2.88	6.35
27A	Muncie†	125	10	480	3.47	2.88	6.35
34A	Bessemer	85	4	320	3.47	4.50	7.97
23A	Fairbanks-Morse	75	3	300	3.57	5.27	8.84
41A	Buckeye	65	....	125	3.57	7.78	11.35
32A	Bessemer	85	10	125	3.62	7.04	10.66
11A	Brim	100	5	290	3.83	5.14	8.97
36A	Muncie	100	12	400	3.96	3.40	7.36
13A	Bessemer	85	4	200	4.14	6.40	10.54
22A	Muncie	85	17	250	4.16	4.09	8.25
44A	Bessemer	85	4	210	4.72	7.65	12.37
29A	Rumley	60	12	150	5.91	4.38	10.29
48A	Muncie	100	13	450	6.25	2.19	8.44
43A	Muncie	85	13	140	6.83	7.77	14.60
47A	Bessemer	80	14	200	8.79	6.55	15.34

*Joint ownership.

†Joint ownership.

TABLE VII.

OUTLAY FOR IRRIGATION ON RICE FARMS USING DIESEL ENGINE PUMPING PLANTS, ACADIA PARISH, 1929.

Farm No.	Make of Engine	Horse Power	Age	Acres Flooded	–Outlay per Acre– Operating	Over-head	Total
44	Fairbanks-Morse	125	2	450	$2.24	$3.71	$5.95
63	Giant	80	10	100	2.26	9.44	11.70
60	Giant	80	8	175	2.46	6.74	9.20
23	Primm	70	5	408	2.56	3.40	5.96
64	Primm	100	10	200	2.56	4.11	6.67
38	Bessemer	50	4	130	2.62	7.68	10.30
33	Muncie	70	10	160	3.11	6.48	9.59
57	Giant	100	4	390	3.14	2.89	6.03
5	Brim	100	7	550	3.18	2.98	6.16
1	Brim	100	9	530	3.66	3.13	6.79
48	Giant	80	10	250	4.78	5.68	10.44
2	Muncie	100	9	325	4.94	3.82	8.76
36	Muncie	100	9	100	5.12	11.76	16.88
58	Giant	80	4	252	5.78	4.06	9.84
3	Giant	100	10	194	6.15	5.76	11.91
61	Giant	100		100	10.13	4.52	14.65

Adjusting the outlay for a crude oil plant to the rest of the business is more difficult than for an electric motor. For the small farmer the smallest Diesel unit was nearly above his means financially and poorly adjusted to his size of farm. This lack of adjustment makes costs high relative to income. Some idea of the economies secured in the adjustments may be gained from data in Tables VIII and IX.

The individual farmer considers his outlays in relation to whatever alternative he has available. Some of them must use deep wells, for no canals are accessible. Having no choice at the time, Diesel engines were the most profitable. Now a new source of power becomes available in the form of electrical energy. With most Diesel engine operators the choice of investment is now between the present worth of the engine and the outlay necessary to install an electric motor. If the Diesel engine is still in good repair and yet the operator finds no sale for it, then he can well figure that to him the whole outlay for its operation is current. There is no investment involved in it. Under such a condition he can well afford to continue, as his saving would be large. The difference would be that between total expense for an electric motor and operating expense for a Diesel engine.

AVERAGE FUEL AND OIL REQUIREMENTS FOR DIESEL ENGINES

A knowledge of unit physical inputs in operating a Diesel engine enables one to better project and budget his expenses when price conditions are changing. The unit inputs for each engine were secured as well as the financial outlays which are presented as a part of this report. The average and range of the most significant physical outlays per one hundred acres flooded were as follows:

	Average	Range
Crude Oil Fuel, barrels	88	50 to 150
Cylinder Oil, barrels	2.1	1 to 3

TABLE VIII.

RELATION BETWEEN ACRES FLOODED AND OUTLAY FOR DIESEL PUMPING PLANT OPERATION AND OVERHEAD, ACADIA AND JEFFERSON DAVIS PARISHES, 1929.

Acres of Rice Flooded	Number of Farms	Average Acres Flooded	Outlay per Acre	
			Operating	Overhead
0-100	3	100	$5.84	$8.57
101-200	14	166	3.99	6.39
201-300	9	259	3.73	4.82
301-over	14	423	3.44	3.15

TABLE IX.

ADJUSTMENT BETWEEN AREA FLOODED AND LABOR FOR OPERATING DIESEL ENGINE AND HAULING FUEL, 1929.

Acres of Rice Flooded	Number of Farms	Average Acres Flooded	Labor Outlay per Acre	
			Operating Engine	Hauling Fuel
0-100	3	100	$ .94	$.20
101-200	14	166	1.34	.19
201-300	9	259	1.16	.22
301-over	14	423	.90	.34

These variations are influenced by size of engine, rate of pumping, mechanical condition of engine, quality of the crude oil fuel, and whether the engine is run wet or dry. The crude oil used for engine fuel is the natural product of petroleum wells located in the rice growing area of Louisiana. It has been the experience of some farmers that the quality of such crude oil may vary widely. Under these conditions physical inputs necessarily increase if a farmer gets much of the lower grade fuel.

ELECTRIC MOTOR OPERATION

The use of electric motors to drive deep well pumps is a comparatively recent development in rice farming. Motor installation began actively in 1926, making the oldest motors operated four seasons at the time this study was made. Installation is going forward rapidly, indicating that farmers are generally agreed relative to the economy of motor operation. There is a convenience in financing and operating electric motors not possible in most instances with Diesel engines. This may be illustrated by the high prices of Diesel engines at the close of the war period, for which a large original investment has had to be paid during a period of rapidly declining prices. Two types of electric motors are used, the horizontal or belt drive, and the vertical or direct drive. The horizontal drive may have a pulley adjusted for the purpose of changing the throw of water. This permits some economy when less water is needed; however, the horizontal drive requires attention in keeping the belt properly tightened. Other disadvantages consist of foundation outlay and larger building space.

The vertical drive appears to be the most compact and free of mechanism which may get out of order in operation. Little building space is needed. The motor sets directly over the well and is attached to the pump shaft. A different pump is practically necessary when the direct or vertical drive motor is used. But most farmers using motors have found it desirable to install the lighter and speedier pump.

Labor needed for attending the motor is negligible. A few minutes are required every day to refill the oil cups on the pump and to see that the power has not been cut off by electrical storms. Thus the farmer who has developed an organization requiring more labor than is normally available in his family is able to save about $3.50 to $5.00 per pumping day for operating labor plus the fuel hauling outlay. There is less opportunity for the farm family to increase its income through the utilization of family labor when electric motors are used. However, the loss resulting from this adjustment is minor if the farm is organized so that such labor is best used during the balance of the season.

Practically all electric motors are insured against breakage so that the repairs will be made without charges to the operator other than the insurance premium. This insurance is issued for a three-year coverage. The rates quoted by farmers getting such protection varied from about $90.00 to $150.00 for three years. This charge depends upon size of motor. Farmers using motors seem to be well satisfied with this method. There is a distinct technical advantage in handling the installation and repair of motors compared with Diesel engines.

A summary of data consisting of outlays and accomplishments of electric motors is presented in Table X. The sample is small, yet indicates the relative proportion of motors and Diesel engines in the area studied. These data also throw some light on the chief objections raised by many motor users. The operating outlay is high relative to the overhead outlay. It will be noticed that on the small farms both operating and overhead outlay are relatively high. This is due partly to the higher charge for the first units of electrical energy consumption. The system used for 1929 by the service companies was to operate on a monthly basis with a graduated rate as kilowatt consumption increased. A distinct advantage appears in the case of the large farms. The larger units were able to use more of the energy secured at the lower rates. For the 1930 season a flat rate per unit of energy was planned by some of the power companies. This charge apparently would favor the small operator and act as a disadvantage to the large operator.

An advantage of the areas where electric motors are used is the adoption of electrical conveniences in the farm home. This condition is extremely hopeful. It makes possible electrical refrigeration, radio operation, electrical heating; and the operation of such farm and home equipment as cream separator, washing machine, sewing machine, and other devices. Considered from the standpoint of farm life, access to electrical power is an inestimable factor. Since our objective is an improved system of living through greater family income and opportunity to enjoy convenience, electrical energy as a source of irrigation power has much to commend it, because of the opportunity to add to the conveniences of home life.

TABLE X.

OUTLAY FOR IRRIGATION ON RICE FARMS USING ELECTRIC MOTORS FOR PUMPING, ACADIA AND JEFFERSON DAVIS PARISHES, 1929.

Farm No.	Make of Motor	Horse Power	Drive	Age	Acres Flooded	–Outlay per Acre– Operating	Overhead	Total
42A	Fairbanks-Morse	60	V	1	580	$2.12	$1.16	$3.28
9A	General Electric	50	V	4	220	2.65	4.18	6.83
15A	General Electric	60	V	3	330	4.47	2.14	6.61
16A	Fairbanks-Morse	100	H	2	350	4.57	1.83	6.40
2	Fairbanks-Morse	100	V	1	450	4.77	1.38	6.15
59A	Fairbanks-Morse	50	V	2	400	5.00	1.84	5.84
25A	General Electric	75	H	3	170	5.28	3.64	8.92
18A	General Electric	40	H	1	143	5.77	4.43	10.20
33A	General Electric	100	V	4	500	5.85	1.89	7.74
42	Fairbanks-Morse	75	H	1	354	5.85	2.27	8.12
46A	Westinghouse	100	V	4	400	6.09	2.76	8.85
31A	Westinghouse	75	V	3	275	7.16	3.74	10.90
10A	General Electric	60	V	3	140	7.28	5.40	12.68
14A	General Electric	100	V	3	400	7.63	3.44	11.07
50A	Westinghouse	40	H	1	130	7.61	5.18	12.80
28A	General Electric	50	H	1	175	7.69	2.94	10.63
8A	General Electric	75	V	4	180	7.94	4.96	12.90

THE IRRIGATION UNIT AND LABOR INCOME

So far this discussion has been confined primarily to the details of an irrigation plant. Little consideration has been given to the entire business in which the irrigation plant operation is but a part. The aim and assumption worked under is that the economies suggested for the plant will increase the returns for the whole business. The goal has been more income for the business and especially more for the efforts of the farmer. Let us carry this analysis to the incomes received on the farms under examination.

The farmer who is unable to operate a large business unit does not fit into an organization including a pumping plant. Thus, certain demands are made of the farmer in order to enable him to operate a large enough rice acreage to justify the installation of such a plant. Because of managerial qualities needed to handle a superior business, the expected labor income is higher. Under actual conditions, the possibility of a more profitable adjustment for all factors employed comes with larger business units.

Results of the farm businesses studied indicate that the farmers using individual irrigation systems handled twenty-five to fifty per cent more acres of rice and secured higher incomes than did the farmers who paid a water rental. The comparative data are presented in Table XI. The farmers using Diesel pumping plants handled twenty-five per cent more acres of rice than did the average canal farmer, and secured thirty-five per cent higher labor incomes. The electric motors were on still larger farms, the average acreage of rice being fifty-four per cent higher than the average size of farms paying water rent. The labor income for operators of electric motor farms was seventy-two per cent higher than that of farmers renting their water.

TABLE XI.

RELATION BETWEEN ACRES OF RICE, SYSTEM OF IRRIGATION, AND LABOR INCOME, ACADIA AND JEFFERSON DAVIS PARISHES, 1929.

System of Irrigation	Number of Farms	Acres of Rice per Farm	Average Labor Income
Water Rent	62	173.5	$1,271
Diesel Engines	41	217.1	1,794
Electric Motors	16	267.7	2,273

SUMMARY

1. The yield per acre of rice was slightly higher on the farms using deep well water. The greatest difference was in the Fortuna variety. It is doubtful whether the water source is the determinant factor.

2. Over half of the farmers interviewed were using deep well water for irrigation, and most of them were actually in charge of an irrigation outfit.

3. Two-thirds of the irrigation plants had Diesel engines.

4. The usual size of Diesel engine has a capacity suited to flooding a larger acreage than prevails on many rice farms.

5. The proportion of the farm investment in the irrigation plant varied from 20.5 per cent on the small farms to 10.3 per cent on the large farms.

6. Water rentals vary directly with yield per acre and the price of rice. The rental is usually one-fifth of the rice crop delivered in the warehouse. For 1929, the rental ranged from $9.31 on the farms flooding one hundred acres or less to $10.52 on farms.

flooding one hundred one to two hundred acres. The average yield per acre for the two size groups was 10.0 and 11.3 bags, respectively.

7. About sixty per cent of the farmers using Diesel engines flooded for a total outlay of $5.00 to $10.00 per acre. Seventy per cent of them had operating outlays of less than $4.00 per acre. Farmers equipped to flood four hundred acres were able to keep their total outlay to about $6.50 an acre. Those operating from one hundred one to two hundred acres had a total outlay of $10.38 per acre.

8. Operating labor outlay tends to decrease as area flooded is increased because the total outlay for pumping labor increases very little after the pumping requires the attention of two full time men.

9. Electric motors are rapidly replacing Diesel engines as a source of power for irrigation purposes. All of the motors on the farms studied were installed during the last four years, while only thirty per cent of the Diesel engines were installed that recently.

10. Diesel engines can be operated at a much lower operating outlay than can electric motors. The farmer takes the correct position in considering only operating outlay compared to total outlay for an electric motor, when his Diesel engine is still giving satisfactory service. It is only when the Diesel engine must be overhauled or is worn out that other needed outlays are involved.

11. The block rate for electrical energy consumption favored the large operator. Small operators were unable to take advantage of the lower range of rates because of low energy consumption.

12. Electrification for irrigation purposes offers an opportunity for farmers to adopt conveniences for the farm and home which are not usually possible where electrical power is lacking.

13. Higher labor incomes were secured by farmers operating private irrigation plants. Much of the difference in income was due to the larger volume of business handled by them.

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Some Economic Problems in the Rice Farming Area, 1929

BY

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SOME ECONOMIC PROBLEMS IN THE RICE FARMING AREA, 1929

(A Preliminary Report)

By

R. J. SAVILLE,

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The aim of an investigation undertaken in the fall of 1929 was to secure facts which would lead to a correct understanding of the problems concerning farm organization and management in the rice area, and what progress successful farmers had made in meeting the situation. If the organization problems are objectively established, farmers and other business interests dealing in rice might judge more correctly what future plans should be made in order to place rice farmers in a more favorable earning position. Many differences of opinion exist concerning the problems because of the influence of price changes on the income of different interested businesses. Also there are many serious problems of a public nature pressing for solution, and upon which much of the future welfare of agriculture will depend. Most of the data forming the basis of this report was secured from 124 rice growers in Acadia and Jefferson Davis Parishes, operating over 25,000 acres of rice which returned them a gross income of a million and a quarter dollars.

It is believed that the farmers interviewed were located in the most favorable rice producing section of the area. It is also necessary to consider population differences prevailing in the area and the forced selection of farmers, because of extremely unfavorable weather conditions which made travel on dirt roads practically impossible most of the time during which field work was in progress. Farm incomes were appreciably enhanced in 1929, due to

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Detailed information concerning the farms studied is presented in Appendix A.

an unexpected high yield per acre, and to a short crop in areas outside of Louisiana. Consequently, these apparent abnormalities have made the situation appear more favorable than actually exists under average conditions.

With normal yield and price conditions, rice growing presents the most profitable type of farming to be found in Louisiana. The volume of business which the individual farmer may handle is large, and is essential for profitable combination of production factors, as we may see in the data to be presented. Volume of business is closely associated with the acreage of rice handled. The comparatively stable yield per acre of rice has always assured a crop, except for those farmers who depend upon surface water and are occasionally injured by salt water. Changes in acreage planted to rice have been chiefly responsible for annual changes in volume of production. Financial resistance has forced extreme limitation on the acquisition of a suitable land area for the proper establishment of an economic unit which will return a high income for the efforts of the farmer. Diversification has only minor significance in the area and indicates a relative shortage of land for rice production. The aims advanced for diversification are best secured by specialization; namely, higher income per worker employed, or for the farm family.

Few practices that promote increased yields of rice per acre have been positively determined, a very favorable condition for farmers when a relatively large supply of the product is less remunerative than a small one. Rice belongs to a class of farm products, such as cotton and potatoes, whose technological improvements leading to increased physical production, while favorable to those accepting them, may be decidedly more unfavorable to the whole industry. This fact will be discussed more at length under price and supply relationships.

SPECIFIC PROBLEMS OF THE FARMERS

The subject matter of the investigation relating to irrigation systems and to power problems is presented in separate reports. The discussion in this report will deal chiefly with four problems of organization and management; namely, price and supply relationship, factors associated with labor earnings, the livestock enterprises, and practices leading to increased yield per acre. It is recognized that problems of individuals are closely identified with problems involving the welfare of all. To this extent the relationship with other problems must not be ignored, though no solution for them is attempted.

From the standpoint of rural welfare in the rice area, a problem appears in the standard of life struggle between those growers trying to secure and maintain high living standards and those having a low standard of life and who are apparently incapable of future improvement. The latter group consists of comparatively small operators able to supply family labor, renting their farms, not interested in public improvements except to enjoy them, and with a low appreciation of family labor utilization and consequential responsibilities of such labor. This problem can hardly be ignored in view of the ultimate condition that low standards may mean low costs of production and low prices for the products, thus defeating the aim of improved rural welfare through increased earnings of farmers. In part it represents a strife between absentee land ownership and resident ownership, the former taking surplus rentals away from the area, the latter using them in the area. Casual observation of conditions indicates the effect of absentee land ownership upon rural welfare in the rice area.

Rice farmers are attempting to pay for high priced commitments with low priced earnings. During the inflation period they received a quick turn on business and subsequently a real estate price boom developed which has slumped just as much no doubt in the post-war depression. Many farmers are paying for losses on commitments in which the investment plays no part whatsoever at the present time. Out of this condition, the banking-farming interests have emerged with lands secured for loans, the same institutions controlling largely the lending to farmers still trying to meet payments on their obligations. When one realizes that rice farming is one of the types of farming demanding most highly of funds, the dangerousness of the banking-farming practice becomes apparent.

The difficulty of getting a properly adjusted size of farm is important and needs special mention. Also, the matter of mineral and oil rights tends to enhance prices of land for other than farming purposes. There appears to be a keen competition for the land and in maintaining high land prices, even though much speculation exists with respect to actual return from such sources. Some changes in organization may be made and would help the agricultural situation in a long time development program. Much may be suggested for improved farm earnings but possibilities are limited unless the major problems are brought to a solution.

The subject matter of this report is a presentation of the data showing the existing, rather than an ideal situation. We may offer the farmer assistance in two rather distinct and separate ways: first, to secure an adequate organization and follow good practices for production; and second, to help him keep informed relative to the supply, actual and estimated, of different products, and what price should be expected under such supply conditions. The latter is frequently referred to as his marketing problem but it involves more than physical marketing or the problem of cooperative selling. It is an attempt to assist him in adequately appraising his product prior to actual sale, and understanding probable changes which will take place. Both of these types of information are his fundamental facts for proper managerial procedure.

CLIMATIC CONDITIONS

Climatic conditions were extremely favorable for the rice crop in 1929. The dry harvest season was the most favorable experienced in many years. However, the extreme rainfall in November and the cold of December made conditions unfavorable for livestock production. A dry April was helpful in getting crops seeded, and abundant rains in May made early irrigation outlay low.

The normal annual precipitation for the rice area is approximately 56 inches. Usually the lowest precipitation is in March and April and the highest in July and August. Precipitation changes are significant in connection with the supply of water available for irrigation purposes. Some farmers believe that rainfall at blossom time is an important factor in yield per acre. Adequate data to determine specific causes of the definite weather and yield relationships are lacking.

Annual precipitation data and the departures from normal for 1929 are available at Jennings, Louisiana (Table 1). In a general way, we may get the tendency of movement between amount and distribution of the annual precipitation and the yield per acre and acreage devoted to rice. The precipitation data as well as those for yield and acreage have been expressed as the per cent of their normal for the comparisons made.

While rice is an irrigated crop and is generally considered free of precipitation influences, nevertheless, significant associations seem to exist between precipitation at given seasons of the year and subsequent variations in yield per acre of rice. In this analysis, classification has been made according to the yield and precipitation on the basis of the nine smallest, eight middle, and nine largest years in per cent of normalcy of precipitation. The association indicates that the nine years of the smallest yield per acre were in years of high late winter and early spring rainfall and extremely low May, June, and July rainfall. The nine years of largest yield per acre have been associated with low early rainfall, and high summer rainfall. There appears to be a slight inverse association between yield per acre and the December and January precipitation. The December and January data indicate, but with less intensity, the same thing that is shown by the February, March, and April precipitation. There is little association indicated between the yield per acre and the acreage. The nine years of largest yield per acre had a slightly higher average acreage than was indicated for the years of medium and smallest yield per acre. The use of the median instead of the arithmetic average caused no significant changes in the results indicated by the data. There appears to be little association between the precipitation for any period of the year and the acreage of rice which follows.

TABLE I.

MONTHLY PRECIPITATION AT JENNINGS, LOUISIANA, NORMAL, AND FOR 1929*

Month of Year	—Precipitation, Inches— Normal	1929	Departure 1929
January	4.75	7.48	+ 2.73
February	3.96	5.73	+ 1.77
March	3.23	2.58	— 0.65
April	3.96	1.71	— 2.25
May	4.73	8.48	+ 3.75
June	4.55	5.90	+ 1.35
July	6.21	4.36	— 1.85
August	6.27	3.04	— 3.23
September	4.38	2.48	— 1.90
October	3.66	2.14	— 1.52
November	3.24	18.26	+15.02
December	5.71	5.68	— 0.03
Annual	54.65	67.84	+13.19

*Climatological Data, Louisiana Section, 1929.

SUPPLY AND PRICE RELATIONSHIPS

SUPPLY AND PRICE

The United States is a surplus rice producing area, even though only a very small per cent of the world rice crop is produced here. Texas, Arkansas, and Louisiana are the leading rice producing states. Approximately 50 per cent of the United States rice crop is produced in Louisiana. Within the state of Louisiana four leading parishes contained more than one-half of the total crop area in 1924, with two of these parishes having over 75 per cent of their total crop area in rice. As a source of gross income the importance of rice goes even beyond this percentage.

An analysis of data for the period 1904-1929 indicates about 72 per cent of the annual average change in supply has been due to changes in the acreage planted to rice. Such a high determination by acreage is excelled by few crops, probably by no crop grown without artificial irrigation. The yield per acre is stable, having a co-efficient of variability of 11.6 per cent compared to 23.1 per cent for acreage. Certainly such stability of yield is not to be found among the other leading crops of Louisiana. Rice production in southwestern Louisiana is dependent entirely upon irrigation from bayous and deep wells. It is necessarily a concentrated crop, offering many difficulties when more diversified systems of farming are attempted.

Few studies have been conducted relative to the economic organization for profitable rice farming. California, with far less production has gone more thoroughly into the management of rice growing than have the south central states. Only recently have rice investigations been undertaken with the aim of giving to growers information relative to profitable practices and desirable organizations. The approach to the problem of supply and price relationships has hardly been considered. When acreage determination of total supply is high, the farmers need to give decidedly more attention to acreage adjustment annually than where yield per acre is the more important determinant. Weather surpluses are largely beyond the control of producers. Acreage surpluses are within their control although they may be unable to make use of this control beyond what past practices have indicated.

Four series of price data were used for the analysis presented here. These consisted of (1) the December 1 farm price of rough rice received by producers;[1] (2) the wholesale price per hundredweight of rough rice at New Orleans;[1] (3) the wholesale price per hundredweight of Blue Rose, clean, at New Orleans;[1] (4) retail price of rice.[2] Data are lacking on the proportion of each year's production which goes into the standard grades for rice. Since the enterprise organization of each farmer is developed on the basis of prices which he receives, the prices paid to the producer are the logical choice for his purpose but they must be continuously reflected to him through their relationship to wholesale prices. Much vagueness may be attached to the farm price paid to producers because of innumerable variations in the nature of the transaction, such as quality, quantity in lot sold, location in area, season of harvest, variety, and other factors. This analysis, however, has taken the farm price for whatever it is worth in lieu of something which would more adequately fit the situation.

In this analysis the price data were divided into two periods, 1904-1915, and 1921-1929. This was done to secure as homogeneous periods as possible. The latter period is more typical of the situation now existing, although the period is not sufficiently long for a high degree of accuracy. However, the nature of the relationship and, to a certain extent, the change from pre-war is brought out. The curves describing the supply-price relationships have been fitted by mathematical formula rather than by the free-hand method. The original data were expressed in per cent of normal, taking the normal as a straight line trend or free-hand curve, whichever seemed to be the most accurate in describing the changes which had taken place. The mathematical formula used here is that developed by Drs. Warren and Pearson.[1] The results of this analysis are presented in Charts 1 and 2, and Tables II and III.[2]

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[1] Yearbook, United States Department of Agriculture.
[2] Bureau of Labor Statistics.

The relationship between the October 1 wholesale price of rough rice at New Orleans and the Louisiana production plus the total carryover may be expressed by the equation $\text{Log } Y = 3.79660 - .8983 \text{ Log } X$. This relationship is practically the same as that between supply and farm price in the pre-war period. The wholesale price in the given year averaged 15 per cent below normal when the supply was 20 per cent above normal. A crop 80 per cent of normal indicated a price 22 per cent above normal. This is for the post-war period 1921-1929.

SIZE OF RICE CROP AND TOTAL VALUE

In order that farmers may gain in relative purchasing power from large crops it is necessary that the price per bushel of rice decline less rapidly than supply increases. In addition, the relative decline in the unit price must permit sufficient margin to pay added outlays imposed on the farmer for handling large crops of rice prior to sale. Most of these outlays are cash transactions involving the purchase of sacks, sewing twine, hire of threshing labor, hauling, threshing machinery, and warehouse charges. That large crops have failed to do this appears from results presented in Table IV. In order to arrive at the total value for the rice crop, the total annual production and the purchasing power of the December 1 farm price per bushel have been used. The pre-war period, 1904-1915, and the post-war 1921-1929 have been divided into relatively large and small crop years.

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[1] Interrelationships of Supply and Price. Cornell Bulletin 466.

[2] The relation of the United States production of rice to the purchasing power of the United States December 1 farm price of rice may be expressed as follows:

1904-1915 $\text{Log } Y' = 3.565974 - .782987 \text{ Log } X$
1921-1929 $\text{Log } Y' = 5.04082 - 1.52041 \text{ Log } X$

The correction factor for the period 1904-1915 is .006169, and for the period of 1921-1929 is .01294.

The relation of the Louisiana production of rice to the purchasing power of the Louisiana December 1 farm price of rice may be expressed as follows:

1904-1915 $\text{Log } Y' = 3.080904 - .540452 \text{ Log } X$
1921-1929 $\text{Log } Y' = 5.05084 - 1.52542 \text{ Log } X$

The correction factor for the periods 1904-1915 is .006364, and for the period 1921-1929 is .01076.

If the above equations are to be used for the purpose of estimating what price would be associated with a given supply, it is necessary to allow for the correction factors which have been introduced in order to make Y equal 100, or normal, when X equals 100, or normal.

The analysis of supply and price relationships has indicated the changing influences which years of large rice crop production have upon the price per unit. The relationship since the war is one of relatively more inelasticity in the price. As a result, the same relative increase in supply depresses the price more severely now than during the pre-war period, and a relative decrease makes the price advance to a higher level. This behavior is in keeping with the data just presented, that with relationships which have come to exist since the World War, large crops are worth no more in purchasing power than are small crops. Prior to the war this was not true if the same analysis is applied in making the determination. Obviously the farmer has a more difficult economic problem in adjusting the acreage planted to rice annually. He is confronted with a puzzling problem of trying to increase his yield, knowing, at the same time, that if normal conditions prevail, others will lose more than he makes.

Chart 1 Relationship Between the United States Supply and Price of Rice, 1921-1929

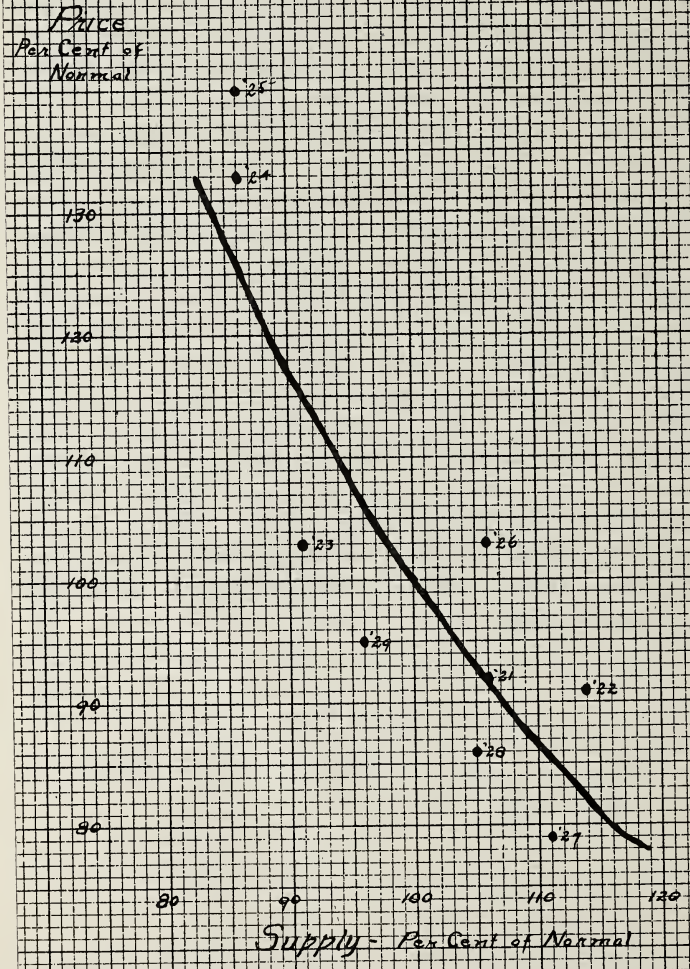

CHART 1.

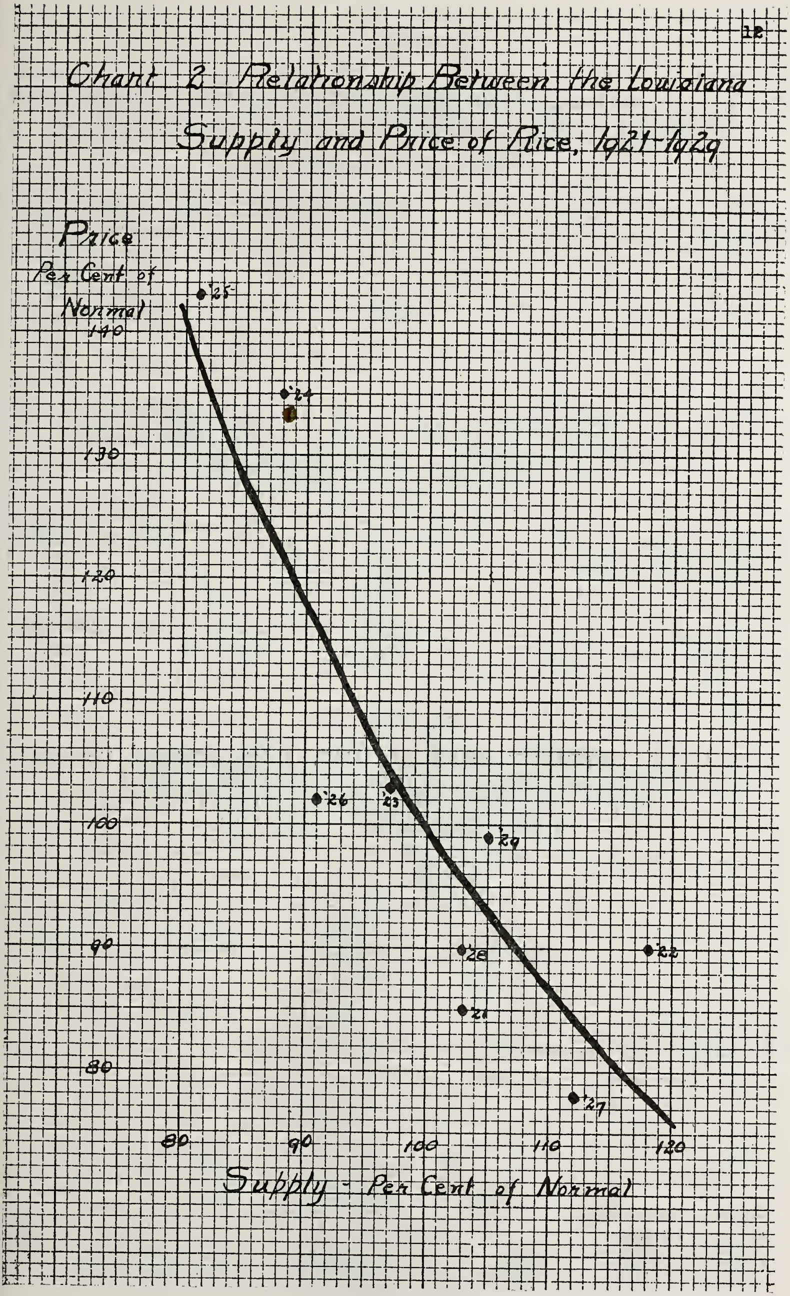
Chart 2 Relationship Between the Louisiana
Supply and Price of Rice, 1921-1929
Price
Per Cent of
Normal
140
130
120
110
100
90
80
'25
'24
'26
'23
'29
'28
'22
'21
'27
80
90
100
110
120
Supply - Per Cent of Normal

CHART 2.

TABLE II. RELATION OF THE UNITED STATES PRODUCTION OF RICE TO THE PURCHASING POWER OF THE UNITED STATES DECEMBER 1, FARM PRICE OF RICE, 1904-1915, AND 1921-1929

Relation of United States Production of Rice to Normal	The Purchasing Power of the United States Dec. 1 Farm Price in per cent of Normal 1904-1915	1921-1929
80	119	140
90	109	117
Normal	Normal	Normal
110	93	87
120	87	76

TABLE III. RELATION OF THE LOUISIANA PRODUCTION OF RICE TO THE PURCHASING POWER OF THE LOUISIANA DECEMBER 1, FARM PRICE OF RICE, 1904-1915, AND 1921-1929

Relation of the Louisiana Production of Rice to Normal	The Purchasing Power of the Louisiana December 1 Farm Price in per cent of Normal 1904-1915	1921-1929
80	113	141
90	106	118
Normal	Normal	Normal
110	95	87
120	91	76

TABLE IV.

RELATION BETWEEN THE ANNUAL PRODUCTION OF RICE AND THE PURCHASING POWER OF THE RICE CROP FOR THE UNITED STATES AND FOR LOUISIANA, 1904-1915, AND 1921-1929.

	TWELVE CROP YEARS, 1904-1915			
	United States		Louisiana	
Size of Rice Crop	Average Production, Bushels	Average Purchasing Power, $	Average Production, Bushels	Average Purchasing Power, $
6 Largest Crops....	25,139,666	$21,257,491	12,403,833	$10,114,147
6 Smallest Crops..	18,965,500	16,803,618	9,550,852	8,458,896

	NINE CROP YEARS, 1921-1929			
	United States		Louisiana	
Size of Rice Crop	Average Production, Bushels	Average Purchasing Power, $	Average Production, Bushels	Average Purchasing Power, $
4 Largest Crops....	42,779,750	$27,081,466	19,520,500	$11,804,250
1 Middle Crop......	40,217,000	26,221,484	17,280,000	11,577,600
4 Smallest Crops..	34,284,000	27,192,218	15,601,750	12,339,185

RICE ACREAGE AND PRICES

Many farmers tend to expand the acreage of a crop when the price per unit for that crop has advanced the preceding year. With most crops, acreage changes are just as important in determining total production as changes in yield per acre. With rice, acreage is decidedly more important than yield per acre. Thus, changing the acreage always has an effect upon subsequent supply. Apparently the response of farmers to price changes, however, is not always made with respect to the demand situation. Thus, for a given year the supply may be short, due entirely to factors affecting yield per acre. Such a change should not be considered one needing correction by acreage changes, except as a larger volume is needed to restore stocks and take care of the normal consumption growth.

Acreage changes may not follow price changes of a particular crop because of competing demands for the use of the land or other factors exerted by other crop enterprises on the same farm. If all the actual prices advanced or declined relatively the same, there would be no special need for acreage adjustments. It is when the relative prices of product from different enterprises get out of adjustment, due to the behavior of producers in bringing forth supplies, that individuals need to make adjustments. If the forecast of acreage for a given crop is desired, not only the price of that crop must be considered, but also the prices prevailing for other crops which may be interchanged with the one in the utilization of the farmers' resources.

In southwestern Louisiana the crops competing most keenly with rice for the use of the land are cotton, sugar cane and corn. All of the area has access to the use of one or more of these crops. Some parts of the area may produce all of them. Except for some natural tillage barriers in the cases of rice and sugar cane, these crops may be freely interchanged on part of the acreage of farms in the area. A study of acreage changes and the behavior of relative prices indicate that farmers have been alert to take advantage of relative price differences by changes in their volume of production. Census data for the two years 1920 and 1925 indicate that cotton, cane, and legume crops increased just equal to the loss sustained by rice and corn, after allowance was made for the general decline in all crop land for the rice area.

The price of rice in Louisiana is closely associated with the United States price. An analysis of the United States price and production data indicate that previous changes in prices show the direction of movement of subsequent acreage but do not give the magnitude. Such an analysis shows that the movement together 19 out of 25 times is a fairly high indication of an existing influence. Since the war, price and subsequent acreage change have been together seven of the eight years, whereas, prior to the war they moved together only seven out of eleven years, and in opposite directions four times.

In Louisiana for the same period, the movement of price and subsequent change in acreage have been together 15 times in 25 years. The pre-war and post-war movements have been 5 out of 11, and 5 out of 8, respectively. Apparently areas other than Louisiana respond more vigorously to price changes. The practice of resting rice land makes acreage changes impossible except on border areas where some land remains in other than rice use part of the time.

GAINS FROM LARGE RICE CROPS

The rice farmer is frequently told that every business in the rice area is solidly behind improved agricultural conditions and a better living in the rural sections, or that the welfare of the area depends upon the welfare of the rice farmers. Probably farmers are coming to realize the grossness of such statements and the real intent of these friendly interests. Other businesses are for agriculture when they can make more money for their businesses. That they make more when farmers make more has serious limitations for certain of the so-called friendly interests. For those who sell to the farmer, certain gains from prosperous farmers are assured. For those whose business is in the distributive process of rice, apparently farmers' losses become their gains. Let us elaborate more fully on this problem.

Rice farmers are indebted for their fixed commitments, and borrow most of their working capital for each year's operations.

This situation in respect to the fixed commitments has existed for the past nine years. Lending agencies are also in the farm real estate business and directly connected with loaning working funds for production as well as marketing. To a limited extent, lending agencies are also in the rice production business as competitors of the farmers who secure short time loans from them.

Agencies handling the rice crop are extremely interested in large crops. If more rice is produced, railroads have more to haul, either as rough or clean rice or rice products. Truck operators who haul rice to the railroad loading stations have better opportunity to recoup for original outlay. Rice buyers, operating on a per bag commission, are able to handle more bags in large crop years. Warehousemen make more if their warehouse space is all in use rather than idle, and if more bags pass through their hands either for original producer or intermediate buyer. Dealers in sacks, twine, fuels, and other articles used in the rice crop are able to get a better inventory turnover and relatively less carryover at the close of each year's business. Teamsters hiring out for harvest find the demand more vigorous in order that each farmer may save his crop. Retailers of seed and fertilizer are in a more favorable light when the goal of agitation is one of expanded production through increased intensity of outlay application.

Wholesale and retail prices of rice and rice products change much less rapidly than farm prices and seldom, if ever, is the intensity of change so great. If the intermediate agencies handling the rice from the time it leaves the farmer until it reaches the consumer also change their unit charge equally slowly, then effects of increased supply react chiefly upon the farmer's price. There is little or no inducement for consumption to change if retail prices are unaltered. At any rate, if the larger supplies would cause the retail and wholesale prices to sag after a few years, the consumer would benefit by the larger supplies.

In the case of rice the farmers are the sufferers for size of crop changes and its effects upon prices which farmers receive. This is the farmers' fault to the extent that annual acreage changes are determining the annual supplies. Since the farmers' price tends to decline more rapidly than increased production in years of relatively large supplies, this means little more than getting a lesser share out of every consumer dollar spent for rice, and these businesses so dependent upon the welfare of the rice farmers get a large share, the reason for their deep interest in the welfare of agriculture. The well known fact that the farmer's interest and that of his friendly sympathizers is diametrically opposed in nearly all business transactions needs clarification and further exposition.

Turning again to the farmer's situation, the technologist points to the fact that the farmer reduces his cost per unit by getting an increased number of units per acre. Quite true, though seldom if ever does he get as much as the increase indicates, even on the amount produced before any increase is obtained. Furthermore the technologist, in looking with joy at the gain to the individual, fails to see the effect upon all individuals, especially those not getting the added units. The discussion which follows presents the data available from which the foregoing statements are drawn. While these data are incomplete and not entirely inclusive for the many points involved, they serve as a guide to the situation. Also, high yields per acre from conscious efforts are not a definite measure of living conditions being obtained. Finally, the lowered cost to produce, which every one except the farmer cites as reason for lowered price, comes out of shrinkage in labor's share and past fixed commitments, rather than out of current purchasable supplies. It is true that the price trend of products which farmers buy is downward, but at this time it is approximately 25 per cent higher than prices for the products he sells, the most favorable for the farmer than it has been in the past ten years.

THEORETICAL RELATIONSHIPS

In order to establish a point of view with regard to size of crop and farmers' purchasing power, a theoretical situation is assumed, using the actual acreage of rice in Louisiana for 1929 and the acreage on the farms studied. Increases in yield per acre are assumed at the rate of one to four bags from an average yield of seven bags. Had average yields of eight or nine bags been used, the loss reported for all the area would have increased, and for the specific area decreased. Otherwise no significant differences would have occurred, even to the extent of short supplies in areas outside of

Louisiana. The objective is to point out a common fallacy in measuring profitableness of returns due to increased physical production when price behavior is disregarded.

The acreages for area not studied and area studied were 465,773, and 25,227, respectively. Beginning with an average yield of seven bags on the total acreage, the yield has been increased by one bag per acre on the area studied, while no change in production takes place in the area not studied. The price per bag has been arrived at by the method discussed under supply and price relationships. Attention is called to the use of two different sets or series of prices, the "usual method" of a flat rate for all increases, and the decreasing price with increasing yield and supply. The "usual method" of stating prices and added returns is one followed in practically all agronomic experiments with varieties, fertilizers, quality factors, and others where checks are used. A display is made of the added profits or returns over the check due to increased production at a constant price. When the price remains the same for each increased physical production, the correct assumption must be that no one will adopt the practice. If, however, the intent is an adoption of the practice, then it will be impossible to secure the price obtained before the increased production was achieved. The complete problem is presented in Table V. Comparisons are made in adjoining columns of the significant facts. Added cost to cover added yield is based upon extra outlays at the same rate which prevailed under average yield conditions. This outlay amounts to approximately 60 cents per bag. Small variations in this item would not change the relative situation.

The comparison which needs emphasis is that between gain and loss to the farmers getting the increase and those not getting the increase, when the "usual method" and when probable behavior are used. It will be noticed that substantial and encouraging results may be shown for the farmers getting the increase, a rather simple phenomenon after all, but larger losses are sustained by those not getting the increased yield due to a small decline in price per unit resulting from the supply added by those getting increased yield. The agronomic experiments show the favorable return, the net purchasing power of the industry shows the losses. Thus a

TABLE V.

DIFFERENT METHODS OF DETERMINING RELATIVE PROFITABLENESS OF SPECIFIC INCREASES IN YIELD OF RICE PER ACRE.

1. Acreage of Rice on Farms not Studied	2. Estimated Production on Farms not Studied at 7 Bags per Acre	3. Acreage of Rice on Farms Studied	4. Assumed Yield per Acre on Farms Studied, Bags	5. Total Rice Production Expected, Bags	6. Production on Farms Studied, Due to Increased Yield Bags	7. Usual Method of Stating Price per Bag	8. Probable Price Farmers Would get per Bag	9. Usual Method for Added Returns Due to Increased Yield 7 x 6	10. Probable Added Returns to Farms Studied due to Increased Yield 8 x 6
(1) 465,773	3,260,411	25,227	7.0	3,437,000	0	$5.81	$5.81	$ 0	$ 0
(2) 465,773	3,260,411	25,227	8.0	3,462,227	25,227	5.81	5.74	146,569	144,803
(3) 465,773	3,260,411	25,227	9.0	3,487,454	50,454	5.81	5.68	293,138	286,579
(4) 465,773	3,260,411	25,227	10.0	3,512,681	75,681	5.81	5.61	439,707	424,570
(5) 465,773	3,260,411	25,227	11.0	3,537,908	100,908	5.81	5.55	586,276	560,039

11. Estimated Added Cost Due to Increased Yield	12. Usual Method of showing net Returns 9—11	13. Probable Net Returns to Farms Studied Due to Increased Yield	14. Probable Gross Returns to Farms not Studied 2 x 8	15. Probable Decrease in Returns to Farms not Studied	16. Probable Gross Returns to Farms Studied 3 x 4 x 8	17. Probable Returns to Entire Area 14+16	18. Probable Loss to the Industry 13—15	19. Total Rice Production Expected, Bushels	20. Price per Cent of Normal
(1) $ 0	$ 0	$ 0	$18,942,988	$ 0	$1,025,982	$19,968,970	$ 0	15,275,556	124
(2) 15,388	131,184	129,415	18,714,759	228,229	1,158,424	19,873,183	— 98,814	15,387,676	123
(3) 30,777	262,361	255,802	18,519,134	423,854	1,289,604	19,808,738	—168,052	15,499,796	121
(4) 46,165	393,542	378,405	18,290,906	652,082	1,415,235	19,706,141	—273,677	15,611,916	120
(5) 61,554	524,722	498,485	18,095,281	847,707	1,540,108	19,635,389	—349,222	15,724,036	119

favorable increase per farm by the "usual method" of $1,000 to $4,000 really is a net loss of $700 to $3,000. In periods of relatively short supplies of rice, a knowledge of improved practices for increasing yield would add to the farmers' purchasing power; in periods of relatively large supplies, a knowledge of improved practices leading to increased yield quickens the competition and prolongs the adverse position.

INVESTMENT CLASSIFICATION

Investments for rice farming are much higher than most types of farming in Louisiana. The chief causes of variations for different systems of farming are due to ownership of an irrigation outfit, and the total acres of land. Naturally high investment requirements have limited possible competitors for the land to those able to amass a large amount of capital. This condition has been favorable for the rice farming area in many instances, because it has eliminated the farmer lacking in ability and capacity to handle a volume of business which a large rice acreage would normally make possible.

According to the 1925 census, estimates of the real estate investment, that is, land and building, amounted to 83 per cent of the total investment on farms in the four leading rice producing parishes. The inflated prices of the war period and the quickness and sureness of a rice crop drove the land price up quickly. Those who chose unwisely then are now trying to pay for high priced land with low priced products. But this situation is similar to that under which much of agriculture is struggling.

The average increase in investment for an irrigation outfit amounted to $4,000 to $7,000. This does not represent new outfits, but typical conditions for existing plants. Such an investment amounted to about 20% of the total on the smallest farms and 10% on the largest farms. Total investment needs and the classification by items are presented in Table VI. Farmers with irrigation plants had above the average investment in all items. An average for all owner-operated rice farms is presented in Table VII. The investment in irrigation outfit has been omitted in order to make comparisons more nearly similar to size of farm.

Tenant farmers have relatively less invested in each item of the classification than do owners. However, their machinery and equipment more nearly approach owners than other items of their property. This may be explained by the importance of having adequate machinery to operate the rice acreage even though no investment funds are available to carry over supplies or keep livestock. The difference between tenant and owner investments for the larger farms shows this condition more distinctly (Table VIII).

GROSS INCOME AND EXPENDITURES

SOURCES OF INCOME

The income from the actual sales of rice was approximately 90 per cent of the gross income on the farms studied. Those farmers operating the smallest units diversified more, consequently received only 87.4 per cent from rice, whereas 91.5 per cent was secured from rice on the farms having over 300 acres. Rice sales amounted to slightly over 97 per cent of the total crop sales on the average, with the smallest farms showing only 94.7 per cent of the crop sales from that source. The tendency for rice sales to form a higher per cent of the gross income in Acadia Parish is shown in Table IX.

TABLE VI.

AVERAGE INVESTMENT FOR OWNER OPERATED RICE FARMS, ACCORDING TO SIZE OF FARM, ACADIA AND JEFFERSON DAVIS PARISHES, 1929.

Acres of Rice per Farm	AVERAGE INVESTMENT PER FARM					
	Number of Farms	Real Estate	Live-stock	Machinery and Equipment	Feed and Supplies	Total*
0-100	16	$10,107	$ 974	$ 843	$124	$12,048
101-200	40	18,120	1,459	1,783	261	21,623
201-300	25	24,924	2,137	2,680	348	30,089
301-over	20	35,963	3,836	3,189	506	43,494

*Exclusive of Investment in Irrigation Outfit.

TABLE VII.

AVERAGE INVESTMENT ON RICE FARMS HAVING PUMPING OUTFITS, ACCORDING TO SIZE OF FARM, ACADIA AND JEFFERSON DAVIS PARISHES, 1929.

Acres of Rice	AVERAGE INVESTMENT PER FARM				
	Real Estate	Live-stock	Machinery and Equipment	Feeds and Supplies	Pumping Outfit
0-100	$16,695	$1,361	$2,044	$301	$5,250
101-200	20,883	1,586	2,052	252	4,068
201-300	33,704	2,603	3,264	384	6,562
301-over	43,537	5,139	5,251	745	6,092

TABLE VIII.

AVERAGE INVESTMENT ON TENANT OPERATED RICE FARMS, ACCORDING TO SIZE OF FARM, ACADIA AND JEFFERSON DAVIS PARISHES, 1929.

Acres of Rice	AVERAGE INVESTMENT PER FARM				
	Number of Farms	Live-stock	Machinery and Equipment	Feed and Supplies	Total
0-100	6	$ 739	$ 590	$ 29	$1,358
101-200	11	1,261	1,510	68	2,839
201-300	4	1,038	2,106	193	3,337
301-over	2	878	2,441	429	3,747

TABLE IX.

PER CENT OF GROSS INCOME AND CROP SALES FROM RICE, ACCORDING TO SIZE OF FARM, ACADIA AND JEFFERSON DAVIS PARISHES, 1929.

Acres of Rice per Farm	Per Cent Gross Income From Rice Sales			Per Cent Crop Sales From Rice
	Acadia Parish	Jeff. Davis Parish	Total	
0-100	87.2	90.4	87.4	94.7
101-200	92.1	89.6	90.5	97.7
201-300	91.9	88.8	90.3	97.6
301-over	92.9	90.4	91.5	97.4

In addition to rice sales the seed rice carried over for the next crop accounted for most of the increase in inventory for feeds and supplies (Table VI). This item is of little significance in gross income as it only amounts to about one per cent of the rice sales. The relative importance of livestock enterprises as a source of income may be ascertained from an examination of data in Tables X and XI. The income from livestock is from four to seven per cent of crop sales. This data, however, is the balance, as livestock purchases for replacement and improvements are already deducted, whereas crop sales are gross amounts at the actual price received. Gross sales of rice varied from an average of $3,180 on farms of less than 101 acres of rice to $17,333 on farms of over 300 acres.

TABLE X.

SOURCES OF GROSS INCOME, ACCORDING TO SIZE OF FARM, ACADIA PARISH, 1929.

	AVERAGE PER FARM					
Acres of Rice per Farm	Number of Farms	Crops	Livestock	Other Sources	Inventory Increase	Total Income
0-100.............	20	$ 3,414	$146	$101	$ 38	$3,699
101-200.............	20	7,989	216	162	92	8,459
201-300.............	14	13,300	289	232	146	13,976
301-over.............	10	17,084	223	593	112	18,012

TABLE XI.

SOURCES OF GROSS INCOME, ACCORDING TO SIZE OF FARM, JEFFERSON DAVIS PARISH, 1929.

	AVERAGE PER FARM					
Acres of Rice per Farm	Number of Farms	Crops	Livestock	Other Sources	Inventory Increase	Total Income
0-100.............	2	$ 2,769	$239	$ 0	$ 0	$ 3,008
101-200.............	31	7,942	517	147	81	8,687
201-300.............	15	11,534	676	359	275	12,844
301-over.............	12	18,395	779	326	234	19,734

The gross addition for livestock, the amount above replacement and improvements, amounted to 18.3 cents per bag of rice produced, or 14.7 cents per barrel. On such a basis of comparison it becomes evident that getting a few cents more per barrel of rice offers as much chance for increased gross income as producing livestock.

Income from "other sources" includes team hire, tractor hire outside contract threshing, and supplying irrigation water for other rice growers. The two latter items comprise most of this source.

EXPENDITURES

In order to get comparable situations for items of outlay on rice farms, it was necessary to divide the farms into groups according to tenure and source of irrigation water because land and water rentals have been included as a part of the current crop year outlay. In arriving at gross income, all the rice produced was considered income to the operator. Under expenditures the shares given for water, seed, and land rentals are treated as current outlays. After classification for the above facts had been made, data were assembled for owner-operated farms paying water rent and those operating irrigation plants. The number of farmers operating a pumping plant and having less than 101 acres of rice was insufficient to be used in getting comparative results, as was also the number of tenants.

Current outlays represent actual outlays rather than estimated allowances for water rent and real estate maintenance. Variations will occur even after certain selection has been made to eliminate major differences. This will be seen in the paying of water and land rent by farmers, due to extra land used or the need of more water than they were able to supply from their irrigation plants. The distribution of items of outlay for farms of different sizes is presented in Tables XII and XIII. It will be noted that the total current expenditures for farmers paying water rent increased more rapidly than did such expenditures for farmers operating their own irrigation plant. Part of this difference is due to the overhead outlay for irrigation plants, items not included here. Economies of irrigation from individual plants on larger sized farms is another significant factor.[1]

For the owner operator farmers paying water rent, the average outlay of current expenses varied from $2,678 on farms of less than 101 acres to $12,834 on farms of more than 300 acres of rice. A few significant changes in direction of expenditures may be noted for different sized farm groups. As the average size of farm increased, wages and perquisites, fuel, oil and grease, and land rent increased; and cropper labor, feed, auto, real estate maintenance, and taxes decreased relative to size. But some noticeable changes appear in the relative outlays for different sized farms when the farmer operated an irrigation plant. Wages and perquisites, machinery repairs, fuel, oil and grease, and real estate taxes were relatively more important, and land and water rent much less significant.

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[1] The discussion of irrigation systems is presented as a separate report of this study.

TABLE XII.

CURRENT EXPENDITURES BY RICE FARMERS PAYING WATER RENT FOR IMPORTANT ITEMS, ACCORDING TO SIZE OF FARM, ACADIA AND JEFFERSON DAVIS PARISHES, 1929.

	ACRES OF RICE PER FARM			
Items of Expenditure	0 to 100	101 to 200	201 to 300	301 and over
Wages and Perquisites	145	$598	$1,523	$1,884
Cropper Labor	152	56	90	250
Other Labor	1	23	2	4
Machinery Repairs	96	224	354	525
Real Estate Maintenance	42	120	117	106
Fence Repairs	21	33	60	49
Feed	166	381	447	443
Fertilizer	42	162	191	362
Seed and Trees (Not rice seed)	29	15	26	21
Fuel, Oil and Grease	131	215	535	745
Auto for Farm Use	99	160	239	93
Rice Crop:				
Seed	162	127	340	844
Twine	38	64	94	153
Sacks	116	209	356	582
Storage	42	79	75	286
Hauling	50	56	120	98
Insurance	0	9	13	9
Other	138	141	229	252
Water Rent	765	1,312	2,121	3,522
Land Rent	195	532	1,346	1,807
Real Estate Taxes	207	271	339	562
Miscellaneous	41	89	74	237
Total	$2,678	$4,876	$8,691	$12,834
Number of Farms	12	14	11	8

TABLE XIII.

CURRENT EXPENDITURES BY RICE FARMERS OPERATING IRRIGATION PLANTS FOR IMPORTANT ITEMS, ACCORDING TO SIZE OF FARM, ACADIA AND JEFFERSON DAVIS PARISHES, 1929.

Items of Expenditure	Acres of Rice per Farm		
	101 to 200	201 to 300	301 and over
Wages and Perquisites	$959	$1,607	$2,116
Cropper Labor	81	222	407
Other Labor	62	56	0
Machinery Repairs	277	399	426
Real Estate Maintenance	175	257	201
Fence Repairs	51	70	150
Feed	285	416	364
Fertilizer	234	304	330
Seed and Trees (Not Rice Seed)	25	39	41
Irrigation Plant:			
Fuel and Oil	317	372	477
Electricity	221	495	1,012
Repairs	64	168	150
Fuel, Oil and Grease	314	571	649
Auto for Farm Use	191	190	116
Rice Crop:			
Seed	165	282	464
Twine	88	133	174
Sacks	284	416	553
Storage	101	245	380
Hauling	101	85	200
Insurance	21	45	48
Other	136	53	47
Water Rent	23	0	170
Land Rent	177	265	160
Real Estate Taxes	408	658	785
Miscellaneous	82	135	119
Total	$4,842	$7,483	$9,539
Number of Farms	26	14	12

LAND USE BY CROPS

It has been pointed out previously that rice occupied about 94 per cent of the crop area handled by the farmers interviewed in 1929. This includes the resting land which may be cropped with cotton, corn, or legumes during the idle year for rice. A few farmers grow rice two years in succession and let the land lay out for two years. Attempts to grow rice for more than one year without resting the land have proven unsatisfactory from an income standpoint and is only done when financial pressure is such that the farmer feels he must get a certain sum out of the land at present or he will lose all real estate commitments. Farmers are certainly aware of the evils which will ultimately result from over cropping with rice.

Rice occupied from 81 to 90 per cent of the land tilled in 1929. Cotton acreage was second in importance and occupied about 50 to 70 per cent of the remaining tilled land. Corn occupied about half of the tilled land devoted to the minor crops. The acreage per farm of the leading crops is presented in Table XIV. Other crops included sweet potatoes, legumes and a few truck crops. There was little indication from the data in this study that diversification for crops was profitable. This is probably the best explanation of the present diversification status (Table XV).

The much debated legume crop question was studied in so far as the sample permitted. Only twenty-five of the farmers interviewed were growing legumes in 1929. The average acreage per farmer was 7.5 in Acadia and 15.8 in Jefferson Davis. The acreage of legumes increased as the size of farm increased. General conditions of these farms will be discussed under yield per acre. On the smaller rice farms the tendency was greater to grow wage cotton rather than use share tenants. Of the 51 farmers operating over 200 acres of rice, 16 of them had no cotton and nine grew wage cotton. About 50 per cent of all the farmers grew corn. The usual practice was to give the share tenant some corn as well as cotton land.

TABLE XIV.

USE OF CROP LAND ON RICE FARMS OF DIFFERENT SIZES, ACADIA AND JEFFERSON DAVIS PARISHES, 1929.

Size of Farm	Number of Farms	Average Acreage per Farm (All Farms)			
		Rice	Cotton	Corn	Other Crops
0-100	22	75.3	10.3	3.5	3.4
101-200	51	154.2	10.7	3.9	9.2
201-300	29	249.0	22.2	3.2	4.8
301-over	22	385.6	20.8	10.2	10.3

TABLE XV.

NUMBER OF FARMERS GROWING CROPS OTHER THAN RICE, ACCORDING TO THE SIZE OF FARM, ACADIA AND JEFFERSON DAVIS PARISHES, 1929.

Size of Farm	Total Number of Farms	Number of Farmers Growing:		
		Cotton	Corn	OtherCrops
0-100	22	17	11	19
101-200	51	36	22	34
201-300	29	20	14	23
301-over	22	15	13	11

LABOR INCOME

Labor income is used as the measure of success in the farm business. The method used here in determining labor income differs from that frequently employed in that current rentals for land and water were considered deductable expenditures rather than the farmers' estimate of the investment in real estate and pumping outfit and the current outlays for pumping plant operation and real estate maintenance. The investment estimate was secured for purposes other than that of determining labor income. In determining labor income a charge for land and water rent was made of two-fifths of the rice crop and one-fourth of the other crops. Minor adjustments were necessary for a few individual farmers getting their land slightly lower and furnishing the labor for repairing the improvements, or where an operator also rented the land with seed and water furnished for one-half the crop. Sometimes even the land and pumping outfit were rented together with the operator furnishing all the outlay for the irrigation plant. These were adjusted to conform with the usual rental scheme.

The above method of arriving at income favored the farmers having excessive pasture lands in 1929, for the returns from such lands were not included in the rent. Few instances were found where such lands could command rentals. Rather, farmers short of livestock were anxious to get sufficient stock from neighbors to keep down weeds and grass, especially on rice land laying out. The amount of pasture land other than that resting for rice use was small and not especially significant in the study. Every inducement was given to show returns from livestock in the labor income.

Labor incomes were enhanced considerably in 1929 due to favorable yields and prices, a happy situation in Louisiana. The most important factor affecting income, obviously, is the acreage of rice handled. Yield per acre increased with income but, other than land claim, was largely outside the control of the operator so far as any dominant tendency was concerned. It is true that price differences for varieties were not sufficient to offset anticipated yield margins. But this factor will be discussed at length under yield per acre and the relation to income. The reader is warned against playing up the yield per acre in its almost constant relationship to higher income. It means nothing more than the truism if a farmer is given more he makes more. Land prices should reflect part of that increased productivity, but the turnover of rice lands is very slow at the present time.

Labor incomes varied from $285 on the farms handling an average of 75.3 acres to $3,096 on farms handling an average of 385.6 acres of rice. These two groups had the lowest average yield per acre, being 9.8 and 10.3 bags respectively. The average for all farms was 203.4 acres of rice, an average yield per acre of 10.7 bags of rice, and a labor income of $1,638. These data are presented for the various size groups in Table XVI. The variation between parishes is quite marked, due chiefly to differences in acres of rice per farm. In Acadia Parish the average acreage of rice per farm in the study was 185.1 compared to 223.0 in Jefferson Davis, and their respective yields per acre were 10.5 and 10.9 bags. Approximately 50 per cent higher labor incomes were received in Jefferson Davis Parish, $1,976 compared to $1,324.

TABLE XVI.

ASSOCIATION BETWEEN ACRES OF RICE, YIELD PER ACRE AND LABOR INCOME, ACCORDING TO SIZE OF FARM, ACADIA AND JEFFERSON DAVIS PARISHES, 1929.

Acres of Rice per Farm	Number of Farms	Average Rice Acreage	Average Yield per Acre, Bags	Average Labor Income
0-100	22	75.3	9.8	$ 285
101-200	51	154.2	11.2	1,379
201-300	29	249.0	10.9	2,016
301-over	22	385.6	10.3	3,096
All Farms	124	203.4	10.7	1,638

PRICES RECEIVED AND LABOR INCOME

Marked variations in the average price per barrel were found for the different sized groups. The smallest group, farmers operating less than 101 acres of rice, received the lowest price per barrel as well as the lowest yield per acre. Farmers operating the largest sized farms, over 300 acres of rice, received the next lowest average price per barrel as well as next to the lowest yield per acre. Rank in price per barrel and weighted average yield per acre were directly correlated.

The average price per barrel for all varieties was $3.67. This price was four cents above the average December 1 farm price (preliminary) reported for the Louisiana rice area.[1] The spread in average price for the size groups was from $3.55 to $3.73.

When the farms were grouped according to the relative labor income for the size group in which each fell, the effect of price becomes more apparent. Those farmers getting less than 51 per cent of the average income for their size group secured an average price per barrel of $3.46, or 21 cents below the average for all farmers. Those farmers securing over 50 per cent above the average of their group received $3.83, or 16 cents a barrel more than the average for all farmers.

Rough estimates may be made of the effect of price changes upon labor income by direct reduction of the amount of gross income obtained. The result for the farms studied is presented in Table XVII, using the average price for all groups, and prices of a definitely lower level. It may be seen that a decline of 20 cents per barrel would reduce the labor earnings for the highest income group 30 per cent.

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[1] Yearbook, United States Department of Agriculture, Page 671.

TABLE XVII.

ACTUAL LABOR INCOME, AND PROBABLE CHANGES IN LABOR INCOME FROM ASSUMED PRICES FOR RICE, ACCORDING TO SIZE OF FARM, ACADIA AND JEFFERSON DAVIS PARISHES, 1929.

Acres of Rice	Actual Labor Income	PROBABLE LABOR INCOME USING			
		Average Price for All Farms 1929	Decrease in the 1929 Price Received of		
			—$.10	—$.15	—$.20
0-100	$ 285	$ 396	$ 194	$ 149	$ 103
101-200	1,379	1,252	1,265	1,058	951
201-300	2,016	1,917	1,671	1,513	1,445
301-over	3,096	3,422	2,605	2,360	2,114

RICE YIELD PER ACRE

Individual farmers are especially interested in getting higher yields per acre than their neighbors. This is true of all crops. Sometimes better producing land may be secured relatively cheaper than poor producing land—producing power here measured in units of physical product harvested. If the rice farmer has to pay for good land in proportion to its contribution to yield, he may not find it any more profitable than land giving a lower yield per acre. With rice the chief problems of yield concern varieties grown, fertilizer practices, and sources of seed planted. The first two are much more agitated than the latter, partly because seed selling agencies are less active in their search for the surplus earnings of rice farmers than are fertilizer selling agencies.

For detailed study of yield per acre it is necessary to keep individual varieties separate with respect to acreage, yield, price, fertilizer practice, and seed used. Little attempt was made to determine the association between the above factors, due to the limited sample and the comparative economic insignificance of some of them. For general comparisons, the weighted yield per acre by farms has been used. In studying the individual varieties, acreage has been classified according to varieties rather than by farms. The average yield per acre and price per barrel according to leading varieties is presented in Table XVIII. The farmers' idea of the variety grown has been used and represents a fairly accurate basis of classification. Those expressing any doubt about the variety of a particular strain like Blue Rose were not included.

Fortuna was the highest yielding variety with Greater Improved Blue Rose and Early Prolific about even for second highest yield. Supreme Blue Rose was the lowest yielding variety. Data on a few other varieties in the area were insufficient to get satisfactory comparisons. These included Edith, Lady Wright, and Blue Stem. The location of the leading varieties shows the preference now existing in the area studied. Yields in Jefferson Davis Parish were slightly higher than in Acadia and prices reported were slightly lower on the average.

TABLE XVIII.

YIELD PER ACRE AND PRICE PER BARREL, ACCORDING TO THE VARIETY OF RICE, ACADIA AND JEFFERSON DAVIS PARISHES, 1929.

VARIETY	Acadia			Jefferson Davis		
	Number of Farms	Yield per Acre, Bags	Price per Barrel, Dollars	Number of Farms	Yield per Acre, Bags	Price per Barrel, Dollars
Early Prolific	25	10.8	$3.67	10	11.2	$3.66
Fortuna	4	11.2	3.63	28	11.8	3.44
Greater Improved Blue Rose	9	11.0	3.88	21	11.0	3.69
Old Blue Rose	37	10.6	3.75	3	....	3.72
Supreme Blue Rose	20	9.4	3.88	18	9.9	3.69

The price per barrel by varieties indicates the problem chiefly neglected by farmers as a group, though keenly considered by individuals. Rather than being taken as final, it suggests the need of further study as to the effect of increased yields upon the price which individual farmers get for specific varieties. There is marked indication that all farmers get less purchasing power in years of relatively large crops and this loss must be taken by farmers, equally or according to their relative supplies. Actually or accidentally, the lowest price in every instance was in the parish getting the highest yield per acre of that variety.

On the basis of the data presented above (Table XVIII), the highest income per acre from rice was obtained from Greater Improved Blue Rose in Acadia Parish and from Early Prolific in

Jefferson Davis Parish. Supreme Blue Rose returned the lowest gross. Except for Supreme Blue Rose, the other varieties returned a gross income, on the average, within the range of $3.75 per acre of each other, a rather insignificant variation. Rice farmers will not continue to grow Supreme Blue Rose for its high milling quality if 1929 yields and price differentials prevail. This would indicate that the tendency towards lower milling quality of the Louisiana rice is due to the relatively unprofitableness of the high quality rice. Farmers, however, expressed the opinion that margins for the milling quality in Supreme Blue Rose in 1929 were less than they had received in the immediately previous years. No data are available to substantiate this opinion or to compare relative prices of the different varieties for a series of years and for different conditions of supply. Current opinions on price decline traceable to inferior quality may get another idea of the consequences of expanded inferior quality production and its apparent profitableness to some farmers at the expense of the industry.

Individual variations between farms is usually cited as reasonable for small differences in yield and price. In order to control these variations, a comparison has been made of all varieties, by groups, including in each group only farms growing the two groups compared and the prices which they received for each variety. This procedure eliminated all farmers growing a single variety. There is still the error which results from differences in seed used, planting dates, flooding depths, soil differences, time of selling, and other practices, but no differences sufficiently tangible to tabulate were possible for these factors. The results of this tabulation are presented in Table XIX. Some marked variations in yield and price occur for the same variety in different compared groups. However, the same price and yield tendency prevails in most instances.

YIELD AND FERTILIZER PRACTICE

The activity of fertilizer agencies in the rice area is normal where farmers are relatively prosperous, even though the attempts to make substantial showings from fertilizer practices are mostly unsuccessful. Reports are available from a reliable source on results of controlled experimental work with rotation and fertilizer applications.[1] These have not increased yields for individuals sufficiently to definitely justify the application. Farmers have been using fertilizer, chiefly the 15-0-6 analysis, on rice and will continue the practice, with small expansion in prospect. The use of commercial fertilizer is more pronounced in Jefferson Davis than in Acadia Parish. Increases due to fertilizer were doubted by many farmers, even among those who have followed the practice several years. This is due to the stimulus of higher yield prospects for a comparatively small outlay in the total farm business. It is a fortunate thing for the rice area that no noticeable increases in yield are possible. Should a practice be introduced at this time which would increase the yield on the farms studied of one bag per acre, the effect would be a loss to the entire rice producers ap-

TABLE XIX.

RICE YIELD PER ACRE AND PRICE PER BARREL ON THE SAME FARMS BY SPECIFIC VARIETIES, ACADIA AND JEFFERSON DAVIS PARISHES, 1929.

Varieties Compared*	Yield per Acre, Bags	Price per Barrel, Dollars	Difference	
			Yield Bags	Price
Early Prolific	11.7	3.69		+.17
Fortuna	12.3	3.52	+ .6	
Early Prolific	10.2	3.67	+1.0	
Supreme Blue Rose	9.2	3.81		+.14
Early Prolific	11.2	3.71	+ .1	
Greater Improved Blue Rose	11.1	3.88		+.17
Early Prolific	10.4	3.66	— .1	
Old Blue Rose	10.5	3.73		+.77
Fortuna	12.2	3.42	+2.0	
Supreme Blue Rose	10.2	3.74		+.32
Fortuna	11.5	3.27	+1.2	
Greater Improved Blue Rose	10.3	3.48		+.21
Fortuna	11.6	3.64	— .1	
Old Blue Rose	11.7	3.78		+.14
Supreme Blue Rose	9.2	3.79	—2.4	
Old Blue Rose	11.6	3.84		+.05
Supreme Blue Rose	10.1	3.84	—1.2	
Greater Improved Blue Rose	11.3	3.82		—.02

*The two varieties compared in each instance were grown on the same farms, though the same farms may not necessarily be included in each comparison of a given variety.

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[1] Annual report Rice Investigations—J. M. Jenkins, Crowley, Louisiana.

proximately twice as great as the directly visible gain to those getting the increases. However, the fact that areas outside of Louisiana have higher yields per acre makes competition for the total output disastrously keen.

TABLE XX.

FERTILIZATION PRACTICES, YIELD PER ACRE, AND PRICE PER BARREL, BY VARIETIES, ACADIA AND JEFFERSON DAVIS PARISHES, 1929.

Variety	Rice Fertilized				Rice Not Fertilized		
	No. of Farms	Yield, Bags x2	Fertilizer, Pounds	Price per Barrel	No. of Farms	Yield, Bags	Price per Barrel
Early Prolific	15	11.3	100	$3.70	21	10.7	$3.65
Fortuna	18	12.3	101	3.44	6	11.2	3.43
Greater Improved Blue Rose	24	11.0	108	3.75	7	10.9	3.77
Old Blue Rose	16	11.1	98	3.80	23	10.4	3.71
Supreme Blue Rose	22	9.7	109	3.77	15	9.2	3.79

A comparison of yields between farmers using fertilizer and those not using fertilizer, influence of factors other than variety not eliminated, is presented in Table XX. For each variety the yield per acre was higher for the farmers using fertilizer on their rice crop. Except for Fortuna, the difference varied from .1 to .7 bags per acre. For the two early varieties of rice and for Old Blue Rose the farmers using fertilizer secured higher average prices for their rice, the range being 1 to 9 cents per barrel. In the case of Greater Improved and Supreme Blue Rose, the price per barrel averaged two cents lower. These price and yield differences are comparatively insignificant.

YIELD AND SIZE OF FARM

The technological solution for farmer difficulties agitated recently is smaller acreages and higher yields per acre, both of which have failed to show anything satisfactory for rice farmers, due to maladjustments on small farms and that small farmers get lower rates of production instead of higher ones. It should be pointed out at this time that certain sized units of the physical factors of production combine most efficiently for the maximum physical volume of production. To change the size may cause little maladjustment in one factor, but at the same time introduce serious maladjustment in other factors from the standpoint of the physical volume of product secured. The farmer should not be interested in the physical volume of production only, but also the economic productivity of expenditures going into the various enterprise—the dollars spent and the dollars recovered.

It has been pointed out in special reports on the irrigation systems and on the use of power machinery that increased rice area and power operations are about the only ways farm operators have of increasing their labor earnings to any extent. In too many instances where labor earnings are low, the land in rice fails to give sufficient annual use to labor and machinery available. But the argument may be presented that these small organizations are balanced because management and capital are limited. Such is true in many instances and the outcome will be one of low absolute incomes and a small volume of purchasing power. The possibility of a high income excludes any such proper combination of factors having so small a magnitude. Developing capable management will be a forward step in improving the labor income situation.

TABLE XXI.

LABOR INCOME ACCORDING TO YIELD PER ACRE, ACADIA AND JEFFERSON DAVIS PARISHES, 1929.

Yield per Acre, Bags	Average Yield per Acre	Number of Farms				Average Labor Income
		0–100	101-200	201-300	301-over	
Less than 8.5	7.7	6	1	1	4	$ 425
8.5—9.4	9.0	1	9	4	3	927
9.5—10.4	10.0	9	9	7	3	1,505
10.5—11.4	11.0	3	8	7	8	1,934
11.5—12.4	12.1	2	13	5	1	1,644
12.5—Over	13.2	1	11	5	3	2,766
Totals and Average	10.7	22	51	29	22	$1,638

The distribution of farms by sizes, according to the yield per acre, and the average labor income by yield groups is presented in Table XXI. The smallest farmers were getting the lowest yields per acre and the largest farmers were next lowest. A few differences in practices are presented, some of which have a traceable bearing on the variation. The two lowest yield per acre groups had the highest per cent of their rice land in late rice, and the group of farmers operating less than 101 acres of rice had predominately Old Blue Rose. Acres per farm studied were larger in Jefferson Davis Parish. More of the farmers operating larger farms used fertilizer than did small farm operators. Also, a higher percentage of the larger farmers planted purchased seed and cleaned the seed before planting.

Another point of view on this problem of yield per acre and its relation to income concerns farmers operating a given area or within an arbitrarily established group. A classification of farms into high and low yield per acre divisions within each size group is presented in Table XXII. These data indicate nothing new in respect to the general notion of yield and income, namely, that farmers operating similar acreages, the higher the yield per acre, the higher the labor income. The significant factor here is the amount of business a farmer is fixed to do. These data indicate that it is more profitable for the farmers operating about 400 acres of rice at an average yield of 8.8 bags per acre than any average acreage below that at even the highest yield per acre obtained. Likewise, farmers operating over 100 acres of rice have a much greater chance at a higher income, even with the lowest average yield, than do farmers with less than 101 acres and getting the highest yield.

TABLE XXII.
VARIATIONS IN LABOR INCOME FOR DIFFERENT AVERAGE YIELDS, ACCORDING TO SIZE OF FARMS, ACADIA AND JEFFERSON DAVIS PARISHES, 1929.

Size of Farm	Number Farms	Average Yield per Acre, Bags	Average Acres of Rice	Average Labor Income
0-100	11	8.6	76.1	$ 238.45
	11	10.9	74.6	331.73
101-200	17	9.4	148.0	1,053.59
	17	11.3	159.8	1,113.18
	17	12.9	154.9	1,968.53
201-300	15	9.7	246.7	1,747.33
	14	12.1	251.6	2,303.00
301-over	11	8.8	386.6	2,188.82
	11	11.8	384.6	4,004.00

RICE YIELD AND THE LEGUME CROP

Increased rice yields by the use of legume crops have been secured in controlled experiments whereas lower yields were secured from the application of commercially mixed fertilizers.[1] The experiment just cited differs from the farmers' practice because relatively little of the rice is grown on the same land continuously for any period. Special effort was made to find out what farmers' opinions are concerning the growing of legumes on their farms. It appears at the present time that the practice is still in the experimental stage. The farmers interviewed were not enthusiastic about legumes for rice, due partly, no doubt, to the adverse season and pests in 1929. It is well to point out that rice is grown under flat culture, while soybeans are grown in rows, necessitating the removal and rebuilding of the rice levees.

Twenty-five of the 124 farmers interviewed grew a legume crop in 1929. According to the classification used here, these farms were slightly above the average size of their respective groups. Their yields of rice per acre were slightly higher than average of all farms in the group for the farms having less than 201 acres of rice and slightly lower than average for those with more than 200 acres. With the exception of one group, 201 to 300 acres of rice, the average labor income for the farmers growing legumes was less than the average for the corresponding size group. In view of acreage and yield per acre conditions, the incomes expected ought to be higher, indicating the possibility that these farmers are seeking a way to increase their gross returns, but have failed to get the proper practice in handling the legume crop. Also, visible cash returns were secured from the legume crop on five of the twenty-five farms the total amount for the five being $121. This cash return amounted to half the original input for seed alone on all the farms growing legumes.

The farmers' problem in connection with growing legumes is to make the practice pay its way directly or in subsequent returns. Considerations other than this are comparatively minor. The growing of soybeans or cowpeas conflicts seriously with rice for the man labor supply. This is further substantiated by the fact that the farmers growing legumes have much greater than average family labor supply, indicating the desire to utilize labor which would otherwise be idle. If row crops are grown on resting land it necessitates an outlay for getting the land smooth and levees constructed again for rice. These added expense items are frequently neglected in the computations and need to have more than mere coverage in physical increase in rice to protect the farmer from legume crop losses such as those suffered in 1929, in years of low rice prices when the volume of production is large, and for defraying expenses in connection with growing the legume crop.

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[1] Report of the Rice Experiment Station for the Years 1928-1929 by J. M. Jenkins, Pages 5 and 6.

THE LIVESTOCK PROBLEM

Beef cattle and poultry production are extremely favorable sidelines for rice growers. It is frequently stated among farmers that beef production is the most profitable enterprise on their farms. This comes about from the relatively high cash returns per unit of cash expense involved.

Dairying involves an entirely different combination of resources than beef production and has little more place on rice farms than it now occupies. Only three farmers in this study were producing market milk and these had developed a specific unit of labor, feed, and investment for their dairy businesses.

Farmers must keep the grass and weeds down on rice land that is resting. If it were not grazed mowing would be necessary. The rice straw must also be disposed of in some manner because the farmer's practice, up to the present time at least, has not made it desirable for him to spread much of the straw back on the rice land. It is true that cotton offers a very favorable opportunity for using rotted rice straw. The possibility of feeding straw for roughing cattle through the winter period when rice stubble pastures are not growing, makes the farmer's cattle feeding practice a very inexpensive one. Of course the feeding value of these products may be poor, but the farmer is correct in judging according to the alternative available for him. Feeds and the feeding practices are good or bad according to the money income obtained for the outlay foregone, rather than the pounds of gain made.

Farm incomes may be increased appreciably by skillful management of livestock production. This expansion in production appears more promising than that of either rice or cotton because increased livestock production will probably not be associated with a more than proportionate decrease in the farm purchasing power obtained by the farmers from such expansion. The greatest need in livestock production appears to be that of improving farmer technique in livestock management in order to conform a little more closely with what controlled experiments show may be achieved relative to breeding, rates of reproduction, gains from balanced rations, and disease control. While it is necessary to recognize the usual limitations which farmers must place on the application of controlled livestock experimental results, yet it appears that rice farmers may effect profitable changes without needing immediate cash outlays.

LIVESTOCK INVESTMENT

Except for work stock, the changes in investment in livestock come about chiefly through natural increases. Cash outlays are chiefly for breeding stock improvement or replacement. In beef cattle production the common practice is to sell only yearling calves and such mature cows as may be replaced by young heifers. Improvement is taking place in the breeding of livestock as evidenced by the purchases of purebred stock during 1929. However, the practice of rearing most of the breeding stock no doubt has been responsible for the inferior quality and physical productivity of much stock in the area. The estimated capital invested in total and by classes of livestock is presented in Table XXIII.

TABLE XXIII.
INVESTMENT IN VARIOUS CLASSES OF LIVESTOCK ACCORDING TO SIZE OF FARM, ACADIA AND JEFFERSON DAVIS PARISHES, 1929.

Acres of Rice per Farm	Number of Farms	Average Investment per Farm, Dollars					
		Work Stock	Cattle	Sheep	Hogs	Poultry	Total
0-100	22	$424	$ 361	$ 0	$57	$68	$ 910
101-200	51	433	816	33	42	91	1,417
201-300	29	675	1,054	16	101	140	1,986
301-over	22	802	2,534	23	99	109	3,567
All Farms	124	553	1,096	22	69	101	1,841

The per cent of the total livestock investment in work stock decreases rapidly as the size of farm increases. For all farms the average investment in work stock amounted to 30 per cent, and cattle about 60 per cent of the total. The investment in cattle increased with size of farm from 40 per cent on farms of less than 101 acres to 71 per cent on farms of more than 300 acres. The largest farmers had a relatively smaller amount invested in poultry, swine, and sheep. The data indicate that as acres of rice increase, more cattle and less other stock become the practice.

THE FEEDING PRACTICES

There is much agitation to get farmers in the rice area to adopt more scientific methods of feeding livestock. The objective is one of greater income from livestock through more than proportionate increases in value product. This information has taken several forms such as reduced numbers and increased feeding, improved breeding for beef production, use of more land for pasture purposes, and improved quality of products to be marketed. The farmer must consider these things in terms of the margin between outlays involved and actual returns obtained and the size of the enterprise possible. If the farmer has no funds and bankers are not interested in making loans for livestock production, then any change involving immediate cash is out of the question. It is in this aspect of livestock improvement that we find the cause for many continued practices, rather than in the lack of technical information on the part of the farmer. The use of borrowed funds for livestock production purposes did not prevail so far as this study could determine.

The farms were divided for each class of livestock into groups using purchased feed and those feeding only home grown feeds. It is well to say that little home grown feed is fed other than to work stock, except the rice roughage, and the screenings which are used chiefly for poultry. The results secured were not consistent with the prospects of usual recommendations. Two conditions of income measure were considered: (1) the addition to income from sales and inventory increases; and (2) this same addition plus the sale price of all products contributed for farm use. The latter condition is better for showing the relative position of livestock enterprises but is highly objectionable if considering sources of cash income to meet cash obligations during the year.

The results of these tabulations by size of farms show an advantage per unit of livestock in favor of the farms not feeding purchased feeds. Income is considered here as the value of produce for farm use plus the addition to income through sales and inventory increases. The use of purchased feeds permits a larger enterprise unit and actually a more profitable one though not so profitable per unit of livestock. The inferior results of farm practices with livestock have been previously mentioned. Data relative to rates of reproduction and losses of young stock were obtained where possible. A tabulation of this data for swine and cattle is presented in Tables XXIV to XXVI. The rates of reproduction for swine are satisfactory if losses were prevented. The matter of proper care must not be overlooked, together with other factors in handling livestock. Losses of pigs ranging from 11.4 per cent to 22.9 per cent are serious handicaps to be overcome when trying to make the swine enterprise add something to the farm income. However, swine production in the rice area needs no further expansion in view of opportunities offered by beef cattle and poultry.

TABLE XXIV.

CALF PRODUCTION AND LOSSES ON RICE FARMS, ACADIA AND JEFFERSON DAVIS PARISHES, 1929.

	Acadia Parish	Jefferson Davis Parish
Average Cows and Heifers	12	29
Per Cent Cows	87.4	80.5
Per Cent Heifers	12.6	19.5
Per Cent Calf Crop	67.9	57.8
Per Cent Calf Deaths	9.8	13.0
Per Cent Cow and Heifer Deaths	5.6	9.4

TABLE XXV.

SIZE OF LITTERS AND PIG LOSSES ON RICE FARMS, JEFFERSON DAVIS PARISH, 1929.

	TIME OF FARROWING		
	Spring Only	Fall Only	Spring and Fall
Number of Sows	14	5	7
Total Pigs Farrowed	90	30	88
Total Pig Deaths	20	5	13
Pigs per Litter	6.4	6.0	6.3
Per Cent Pig Losses	22.2	16.7	14.8

TABLE XXVI.

SIZE OF LITTERS AND PIG LOSSES ON RICE FARMS, ACADIA PARISH, 1929.

	TIME OF FARROWING		
	Spring Only	Fall Only	Spring and Fall
Number of Sows	10	10	10.5
Total Pigs Farrowed	70	85	123.0
Total Pig Deaths	16	17	14.0
Pigs per Litter	7.0	8.5	5.9
Per Cent Pig Losses	22.9	20.0	11.4

Rates of reproduction for cattle tended to be lower on larger farms, indicating possible neglect for an increasing business. Also deaths of calves as well as mature animals were greater in the larger herds. This was apparently a result of poor management as the larger herds tend to be of higher grade stock than are maintained on most of the smaller farms. Substantial gains are possible in combining livestock production with rice, though not to the extent of reducing rice acreage. Rice farmers should plan primarily for rice production on a substantial scale for successful operation. To expand the livestock enterprises the farmers must get an economical unit of expansion which will fit well with the outlay for labor and land or they will be disappointed in finding that expenses involved and foregone in other lines are greater than immediate returns from the livestock added. Farmers increase their livestock enterprises by buying extra feed. Tabulations showing this result are presented in Tables XXVII, XXVIII and XXIX. The reader is cautioned that this considers only two factors, size of farm and use of purchased feed. The kind of feed fed, breed of stock, disease conditions, and other factors are not eliminated.

LIVESTOCK AND INCOME

In order to compare returns from livestock and labor income, the farms were grouped according to actual gross addition to income, or the amount above replacements and inventory decreases, and compared with average labor income for the group. If farms were of an average size there should be an increase in labor income as returns from livestock increased. Three farms where charbon was severe, with losses over $100, and nine farms having receipts over $1,100 were eliminated. Those farmers making less than $200 on livestock received the lowest labor income but also handled the smallest acreages of rice and obtained the lowest yield per acre on the average. Those making from $201 to $500 from livestock had the highest acreages of rice and highest yields per acre and obtained the highest incomes. Corrected for differences in rice acreage and yield per acre, there seems to be a small increase in labor income with gross increases from livestock, though not a very encouraging amount.

TABLE XXVII.

NUMBER OF CATTLE AND INCOME PER ANIMAL UNIT FROM SALES AND HOME USE, ACCORDING TO SIZE OF FARM, ACADIA AND JEFFERSON DAVIS PARISHES, 1929.

Acres of Rice per Farm	FEEDING PRACTICE — Purchased Feed		FEEDING PRACTICE — No Purchased Feed	
	Average No. of Animal Units	Income per Animal Unit	Average No. of Animal Units	Income per Animal Unit
0-100	11.18	$19.10	7.42	$26.77
101-200	29.17	12.02	19.74	16.89
201-300	30.78	11.56	34.43	16.28
301-over	34.14	9.60	33.17	9.85

TABLE XXVIII.

NUMBER OF SWINE AND INCOME PER ANIMAL UNIT FROM SALES AND HOME USE, ACCORDING TO SIZE OF FARM, ACADIA AND JEFFERSON DAVIS PARISHES, 1929.

Acres of Rice per Farm	FEEDING PRACTICE			
	Purchased Feed		No Purchased Feed	
	Average No. of Animal Units	Income per Animal Unit	Average No. of Animal Units	Income per Animal Unit
0-100.............	1.76	$28.26	1.26	$48.08
101-200.............	1.90	24.98	.73	82.50
201-300.............	2.48	43.57	2.09	64.52
301-over.............	4.29	21.76	1.66	72.82

TABLE XXIX.

NUMBER OF POULTRY AND INCOME PER BIRD FROM SALES AND HOME USE, ACCORDING TO SIZE OF FARM, ACADIA AND JEFFERSON DAVIS PARISHES, 1929.

Acres of Rice per Farm	FEEDING PRACTICE			
	Purchased Feed		No Purchased Feed	
	Average No. of Birds	Income per Bird	Average No. of Birds	Income per Bird
0-100.............	100	$1.37	77	$1.35
101-200.............	119	1.35	76	1.48
201-300.............	195	.82	103	1.75
301-over.............	140	.99	114	1.11

The relatively successful farms, those having labor incomes 51 per cent or more above the average for their size group, received the highest income from livestock, while having only an average amount of working capital so invested. The group of farmers making labor incomes 51 to 100 per cent below the average for their group had the highest per cent of their working capital in livestock and made the highest per cent of their gross income from livestock sources, but ranked second in gross income from livestock. Those farmers making minus labor incomes received 3.98 per cent of their gross income from livestock sources compared to the average of 4.11 per cent for all farmers and were the median group in this respect. They were inferior in acreage handled and yield per acre of rice. Also their gross income from livestock was only $223 per farm compared to $400, the average for all farms. It is well to point out that the inefficiencies causing the low labor incomes are now being associated with them. The objective is one of trying to clarify and establish the contributing factors as they affect labor income. All recommendations for farmers are supposed to do that. Many of them either are unsound in the beginning or are uncontrollable in the farmers' hands.

LAND RENT, REAL ESTATE TAXES, AND LABOR INCOME

It has been previously pointed out that the usual rental in the rice area is 20 per cent of the crop for land, 20 per cent for water, and 10 per cent for seed when furnished. For 1929, one-tenth for seed was about twice what seed would have cost because of the favorable yield and more favorable price. This rental for seed is established on the basis of one bag of seed for two acres planted, which is above the average practice slightly and without regard to change in prices.

An explanation of the computation of labor income has already been given (page 31). A comparison of the income by the use of competitive rental, and estimated valuation and outlays is presented in Table XXX. No significant difference was secured when the average of all farms is considered; however, for specific income groups the difference is inverse between income and estimated valuation and outlay. As labor income increased the rental basis became relatively lower. The share for land rents in the rice area has remained practically constant in proportion for many years.

The total land rent may be assumed as necessary to pay for permanent upkeep and repairs, depreciation on improvements, taxes, and the outlay for purchasing the land. These items, except taxes and purchase payments, may be easily postponed if rents are not sufficient to cover them at any time. Taxes are assessed in order to raise a certain volume of revenue, and for real estate the assessment may be irrespective of rents though relatively the same for all land owners. A certain uniformity in assessing is followed with the aim of delivering equal valuation to practically equal portions of property.

TABLE XXX.

COMPARISON BETWEEN METHODS OF DETERMINING LABOR INCOME BY RENTAL AND THE OUTLAY AND EVALUATION BASIS FOR RICE FARMS STUDIED, 1929.

Income Range	Number of Farms	Average Rental*	Labor Income Outlay and Evaluation†	Dollars Difference‡
—$3894 to +247	20	—$ 546	—$1,350	—$804
264 to 766	21	561	429	— 132
818 to 1508	21	1,229	1,025	— 204
1521 to 1890	21	1,704	1,419	— 285
1897 to 3076	21	2,467	2,744	276
3130 to 9462	20	4,443	4,934	491
All Farms	124	1,638	1,529	— 109

*Rental 2/5 for rice land and water and ¼ for other crops.
†Includes all outlays and depreciation on irrigation outfit and real estate.
‡Minus indicates rental basis higher than the outlay and evaluation basis.

The data for assessments was taken from the assessor's books for the farms studied. The land was assessed at an average of $28 per acre in Acadia Parish and $36 in Jefferson Davis Parish. Average total taxes per farm, real estate and movable property, amounted to $506 in Acadia Parish and $572 in Jefferson Davis Parish. The movable property tax for tenants was $18 in Acadia, and $17 in Jefferson Davis. The proportion of the assessed valuation in real estate was 92.6 per cent in Acadia and 86.5 per cent in Jefferson Davis.

A distribution of the taxes paid by source of use is presented in Table XXXI. The difference in the method of listing in the two parishes makes the direct comparison for each source impossible. The only tax not common to all farmers is that of drainage, which applies only to the drainage district served. Considerable variation occurred in local taxes even for the comparatively small area studied.

The use of land rent for sources other than taxes is shown by Table XXXII. Apparently the relative amount of rent absorbed by real estate taxes decreases as the size of farm increases as well as the annual loss on building indicated by depreciation, leaving the per cent of the total rent for land purchase or earnings on investment higher for larger sized farms.

TABLE XXXI.

PER CENT DISTRIBUTION OF TOTAL TAX OUTLAY ACCORDING TO THE SPECIFIED USES, ACADIA AND JEFFERSON DAVIS PARISHES, 1929.

Source of Tax	PER CENT OF TOTAL TAX	
	Acadia Parish	Jefferson Davis Parish
State	14.89	17.80
Parish Highway and School	23.95	12.39
Ward Road	8.54	....
Ward School	26.32	37.21
Road District	15.17	25.89
Drainage	11.13	6.71
Total	100.00	100.00

TABLE XXXII.

PER CENT OF TOTAL LAND RENT FOR DIFFERENT REAL ESTATE USES, ON RICE FARMS, ACADIA AND JEFFERSON DAVIS PARISHES, 1929.

Source of Rent Use	ACRES OF RICE PER FARM			
	0 to 100	101 to 200	201 to 300	301 and over
Real Estate Taxes	25	23	19	18
Insurance	1	2	3	2
Repairs	9	10	7	5
Depreciation	13	11	9	7
Remainder for Other Uses	52	54	62	68
Total	100	100	100	100

REAL ESTATE TAXES AND LABOR INCOME

Another measure of tax burden is the relationship between earnings and payments. Obviously tax assessments do not fluctuate with business conditions, or more specifically, the price of rice, whereas farm incomes are highly sensitive to it. Since 1929 was a very favorable year, the comparison between incomes and taxes is much more optimistic than may normally be expected. Taxes have been included as a part of the current expenses; thus they have reduced the labor income over what would have been secured, by an amount equal to the real estate tax. The writer takes the position that labor income should represent as nearly as possible an amount for family living, obtained through the efforts of the operator.

Taxes on real estate have been expressed as a per cent of the labor income secured after deducting taxes. Thus the relative, 100, would indicate that tax paid was just equal to the labor income after paying the tax, or that the farmer had twice the amount of his tax before payment. The results of this tabulation for farmers owning all the land they operated are presented in Table XXXIII. Again it appears that the small operators have a relatively heavier tax burden than do the larger operators.

TABLE XXXIII.

PER CENT REAL ESTATE TAXES ARE OF LABOR INCOME FOR FARMERS OWNING ALL THE LAND THEY OPERATE, ACADIA AND JEFFERSON DAVIS PARISHES, 1929.

Size of Farm	Number of Farms	Average Real Estate Taxes	Average Labor Income	Per Cent Real Estate Taxes of Labor Income
0-100	11	$228	$ 273	83
101-200	26	416	1,077	39
201-300	11	725	2,539	29
301-over	10	929	2,886	32

SUMMARY STATEMENTS

1. The price of rice has been more sensitive to supply during the period 1921-1929 than for the pre-war period. The analysis indicates that prices change inversely with supply and at a higher relative rate. This has resulted in a lower farm purchasing power for large rice crops than for small ones.

2. Previous changes in the December 1 farm price of rice causes subsequent changes in the acreage devoted to rice and indicate with a high degree of accuracy the direction of the acreage change but do not give the magnitude of change to be expected. The indication for acreage outside of Louisiana is higher than for Louisiana.

3. Since the war the relative price of rice has been below the average for all farm products seven of the past ten years. In the extremely short rice crop years of 1924 and 1925 the relative price of rice was above the retail prices paid by farmers and wholesale prices of non-agricultural products.

4. Wholesale and retail prices of rice have been much slower to change than farm prices and their changes have always been with less magnitude.

5. The practices leading to increased yield of rice per acre have tended to quicken competition among growers, apparently to the benefit of other interests. Increase through the use of improved varieties is the only method definitely determined by which increased yields may be obtained.

6. The size of the Louisiana rice crop relative to the total United States crop seems to be a less important factor than total size of crop in affecting the spread between the December 1 farm prices for the United States and for Louisiana.

7. The price per barrel for the farms studied was four cents above the average (preliminary) reported for Louisiana. Farmers making labor incomes less than 50 per cent of the average for their respective size groups received 21 cents less per barrel than the average for all farmers, while those farmers making over 50 per cent above the average for their size groups received 16 cents per barrel above the average for all farmers.

8. A decline of 20 cents per barrel in the average price of rice would reduce labor earnings approximately 30 per cent over 1929.

9. Income from crops other than rice was hazardous under 1929 conditions. Acreage in cotton and gross income from that source varied inversely with relative labor income for different sized groups. Losses were reported for corn and legumes in 1929.

10. Acreage in rice was the chief factor determining volume of business and labor income. Yield per acre was significant within given size groups but secondary between size groups. Supreme Blue Rose was the lowest yielding variety and gave the lowest average gross return per acre in 1929. Variation in the gross returns per acre from the four leading varieties other than Supreme Blue Rose were insignificant.

11. Beef cattle and poultry production offer the most profitable utilization of the by-products of rice production, namely, rice stubble, rice straw, and screenings.

12. Most of the farmers purchased some feed for work stock. For other classes of livestock the purchasing of additional feed permitted the farmers to expand the enterprises and increase their additions to income from livestock sources. However, the farmers using no purchased feed for livestock usually secured the highest income per unit of livestock.

13. The chief improvements advisable for livestock consist of disease control, prevention of losses among young stock, and increased rates of reproduction.

14. There is a direct association between relative labor income and addition to income from livestock. Farmers making minus labor incomes were inferior in livestock production as well as in rice production.

15. The burden of real estate taxation tends to decrease as the size of farm increases. Also farmers operating less than 101 acres of rice made little more for their labor income than they had to pay for real estate taxes. Farmers operating over 100 acres of rice had for labor income about three times as much as was paid for real estate taxes.

APPENDIX

In order to arrive at many of the opinions presented in the foregoing discussion it has been necessary to make a large number of tabulations to establish and check the results secured. Much tabular material has purposely been presented even to the extent of almost general data. However, there are always those readers anxious to find additional data for different problems, or desiring to place their own interpretation upon the data rather than accept that of the writer. With the idea in mind of making the material collected of increased usefulness, additional tabulations are included in the appendix. Some of these data bear directly upon that presented in the discussion. In other instances the interpretation may appear only as a statement of opinion.

Appendix A, Unit Data for Farms Studied

TABLE XXXIV. SUMMARY OF UNIT DATA SECURED ON RICE FARMS IN ACADIA AND JEFFERSON DAVIS PARISHES, 1929

	Acadia Parish	Jefferson Davis Parish
Total number of farms	64	60
Total acres operated	26,258.5	31,761
Total share tenants	49	59
Total acreage of rice, 1929	11,845	13,382.5
Per cent total acres operated in rice	45.1	42.1
Average size of farm unit	410.29	529.35
Acres of rice per farm	185.1	223.0
Number of farmers getting water furnished[1]	45	20
Farmers using Diesel engine outfits	18	24
Farmers using electric motors	2	16
Other farmers	2	2
Number of tractors	91	90
Number of motor trucks	32	44
Farms having no tractors	7.0	2.0
Farms having 1 tractor	31.0	31.0
Farms having 2 tractors	18.0	23.0
Farms having 3 or more tractors	8.0	4.0
Average labor income	$1,324.00	$1,976.00

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[1] Includes some farms using two sources of water supply.

TABLE XXXV. WEIGHTS AND MEASURES, AND PREVAILING PRICES FOR COST ITEMS, ACADIA AND JEFFERSON DAVIS PARISHES, 1929

WEIGHTS AND MEASURES

Rough rice, per bag, 200 pounds.
Rough rice, per barrel, 162 pounds.
Rough rice, per bushel, 45 pounds.
Cotton, per bale, 500 pounds.
Corn, per barrel, 140 pounds.

PREVAILING PRICES FOR COST ITEMS

Labor:

Day hands with house included, $1.25 to $1.50 per day.
Harvest hands without perquisites, $1.75 to $2.00 per day.
Harvest hands: pitch and haul, $2.00 and one meal per day; sewers, 1 and 1½ cents per sack, or $3.00 to $3.50 per day; draggers, $2.00 to $2.50 and one meal per day.

Threshing Rates:

Men and outfit, and fuel, 17½ cents per bag.
Men and outfit, and no fuel, 15 cents per bag.
Entire crew, except hauling to warehouse, 35 cents per bag.

Rice Materials:

Second hand sacks, 11 to 13 cents each.
New sacks, 13 to 17 cents each.
Binding twine, 12½ cents per pound.
Sewing twines, 60 cents per hundred.

Rice Service Charges:

Hauling, 5 to 12 cents per bag.
Storage and insurance, 7 to 20 cents per bag.

Fuel and Oil:

Gasoline, 15½ to 18½ cents per gallon.
Distillate, 10 cents per gallon.
Crude oil fuel, $1.65 to $1.90 per barrel.
Light cylinder oil, 18 to 20 cents per gallon.
Heavy cylinder oil, 25 to 75 cents per gallon.

Rentals: (Rice crop basis)

Land rent, 20 per cent and no upkeep; 16 2/3 per cent plus man and team labor for upkeep.
Water rent, 20, 22, 22½ per cent.
Land and water rent, 40, 42 and 43 per cent.
Land, water and seed rent, 50 per cent.

Feeds:

Corn, $1.50 per barrel.
Oats, $3.25 to $4.20 per 5 bushel bag.

APPENDIX B—Prices

TABLE XXXVI.

INDEX NUMBER OF UNITED STATES, DECEMBER 1, FARM PRICE OF RICE, THE WHOLESALE PRICE PER 100 POUNDS ROUGH RICE AT NEW ORLEANS FOR OCTOBER, AND THE RETAIL PRICE OF RICE 1919-1929.

Year	United States December 1 Farm Price of Rough Rice * 1910—1914=100	Wholesale Price of Rough Rice October at New Orleans * 1910—1914=100	Retail Price of Rice 1913=100†
1919	318.0	311.8	....
1920	142.0	176.7	200.0
1921	113.4	133.3	109.2
1922	111.0	115.8	109.2
1923	131.4	144.8	109.2
1924	165.2	166.5	116.1
1925	183.4	167.7	127.6
1926	130.7	130.9	133.3
1927	110.8	146.0	123.0
1928	105.6	118.2	114.9
1929	116.7	104.9	111.5

*Yearbook, United States Department of Agriculture 1930, Pages 667, 671.
†Bureau of Labor Statistics, No. 464, Page 7, and supplements.

TABLE XXXVII.

SOME COMPARISONS BETWEEN THE UNITED STATES AND THE LOUISIANA, DECEMBER 1, FARM PRICE OF RICE, 1904-1929, AND FOR SPECIFIC PERIODS (ACTUAL PRICE).

Period and Production	Relation of La. Production to the United States Production in per cent	Average Difference Between the U.S. and the Louisiana Dec. 1 Farm Price of Rice per Bushel Cents
1921-1929		
Four Largest United States Crops......	44	3.3
Four Smallest United States Crops......	46	1.6
Four Relatively Largest La. Crops......	48	2.4
Four Relatively Smallest La. Crops....	43	2.5
Nine Years, 1921-1929..........................	....	3.2
1904-1915		
Six Largest United States Crops..........	48	0.6
Six Smallest United States Crops........	52	1.9
Six Relatively Largest La. Crops........	53	1.0
Six Relatively Smallest La. Crops......	46	1.5
Twelve Years, 1904-1915......................	....	1.3
Five Years, 1916-1920...........................	....	0.0
Twenty-six Years, 1904-1929................	....	1.7

APPENDIX C—Income and Expenditures

TABLE XXXVIII.

ASSOCIATION BETWEEN ACRES OF RICE, YIELD PER ACRE AND LABOR INCOME, ACCORDING TO SIZE OF FARM, ACADIA PARISH, 1929.

Acres of Rice per Farm	Number of Farms	Average Rice Acreage	Average Yield per Acre, Bags	Average Labor Income
0-100.........................	20	75.3	9.6	$ 288
101-200.........................	20	155.8	10.9	1,124
201-300.........................	14	252.9	11.2	1,721
301-over.........................	10	367.3	10.7	3,242
All Farms.....................	64	185.1	10.5	1,324

TABLE XXXIX.

ASSOCIATION BETWEEN ACRES OF RICE, YIELD PER ACRE AND LABOR INCOME, ACCORDING TO SIZE OF FARM, JEFFERSON DAVIS PARISH, 1929.

Acres of Rice per Farm	Number of Farms	Average Rice Acreage	Average Yield per Acre, Bags	Average Labor Income
0-100	2	75.0	11.1	$ 261
101-200	31	153.2	11.4	1,543
201-300	15	244.8	10.6	2,290
301-over	12	400.8	10.0	2,976
All Farms	60	223.0	10.9	1,976

TABLE XL.

ACREAGE OF COTTON AND GROSS INCOME FROM COTTON AND COTTON SEED ON RICE FARMS, ACCORDING TO INDEX OF LABOR INCOME, ACADIA AND JEFFERSON DAVIS PARISHES, 1929.

Index of Labor Income Relative to Average for Size Group	Number of Farms	Average Acres of Cotton	Average Sales of Cotton		
			Lint	Seed	Total
Minus Incomes	12	28.5	$278	$35	$313
0-50	15	23.7	397	35	432
51-100	36	16.8	201	27	228
101-150	31	10.5	138	20	158
151-over	30	8.3	149	20	169
All Farms	124	15.1	204	25	229

TABLE XLI.

AVERAGE ANIMAL UNITS AND OUTLAY FOR PURCHASED FEED, ACCORDING TO RELATIVE LABOR INCOME RECEIVED, ACADIA AND JEFFERSON DAVIS PARISHES, 1929.

Relative Labor Income Received	Number of Farms	Animal Units		Number of Farms Purchasing Feed	Average Outlay for Feed*
		Average Work Stock	Average All Other Livestock		
Minus Income	12	7.67	21.66	11	$293.36
0-50	15	8.47	53.42	15	522.20
51-100	35	6.83	26.09	33	328.24
101-150	32	6.91	18.46	32	298.69
151-over	30	6.73	29.64	29	236.92
Average and Total	124	7.10	27.86	120	$319.35

*For farmers purchasing feed.

TABLE XLII.

PER CENT DISTRIBUTION OF CURRENT EXPENDITURES BY RICE FARMERS OPERATING IRRIGATION PLANTS FOR IMPORTANT ITEMS, ACCORDING TO SIZE OF FARM, ACADIA AND JEFFERSON DAVIS PARISHES, 1929.

Items of Expenditures	Acres of Rice per Farm		
	101 to 200	201 to 300	301 and over
Wages and Perquisites	19.8	21.5	22.2
Cropper Labor	1.7	3.0	4.3
Other Labor	1.3	.8	.0
Machinery Repairs	5.7	5.3	4.5
Real Estate Maintenance	3.6	3.4	2.1
Fence Repairs	1.0	.9	1.6
Feed	5.9	5.6	3.8
Fertilizer	4.8	4.1	3.5
Seed and Trees (Not rice seed)	.5	.5	.4
Irrigation Plant:			
Fuel and Oil	6.6	5.0	5.0
Electricity	4.6	6.6	10.6
Repairs	1.3	2.2	1.6
Fuel, Oil and Grease	6.5	7.6	6.8
Auto for Farm Use	3.9	2.5	1.2
Rice Crop:			
Seed	3.4	3.8	4.9
Twine	1.8	1.8	1.8
Sacks	5.9	5.6	5.8
Storage	2.1	3.3	4.0
Hauling	2.1	1.1	2.0
Insurance	.4	.6	.5
Other	2.8	.7	.5
Water Rent	.5	.0	1.8
Land Rent	3.7	3.5	1.7
Real Estate Taxes	8.4	8.8	8.2
Miscellaneous	1.7	1.8	1.2
Total	100.0	100.0	100.0

TABLE XLIII.

PER CENT DISTRIBUTION OF CURRENT EXPENDITURES BY RICE FARMERS PAYING WATER RENT FOR IMPORTANT ITEMS, ACCORDING TO SIZE OF FARM, ACADIA AND JEFFERSON DAVIS PARISHES, 1929.

Items of Expenditure	Acres of Rice per Farm			
	0 to 100	101 to 200	201 to 300	301 and over
Wages and Perquisites	5.4	12.3	17.5	14.7
Cropper Labor	5.7	1.1	1.0	1.9
Other Labor	.0	.5	.0	.0
Machinery Repairs	3.6	4.6	4.1	4.1
Real Estate Maintenance	1.6	2.5	1.3	.8
Fence Repairs	.8	.7	.7	.4
Feed	6.2	7.8	5.1	3.4
Fertilizer	1.6	3.3	2.2	2.8
Seed and Trees(Not rice seed)	1.1	.3	.3	.2
Fuel, Oil and Grease	4.9	4.4	6.2	5.8
Auto for Farm Use	3.7	3.3	2.8	.7
Rice Crop:				
Seed	6.0	2.6	3.9	6.6
Twine	1.4	1.3	1.1	1.2
Sacks	4.3	4.3	4.1	4.5
Storage	1.6	1.6	.9	2.2
Hauling	1.9	1.1	1.4	.8
Insurance	.0	.2	.1	.1
Other	5.1	2.9	2.6	2.0
Water Rent	28.6	26.9	24.4	27.4
Land Rent	7.3	10.9	15.5	14.1
Real Estate Taxes	7.7	5.6	3.9	4.4
Miscellaneous	1.5	1.8	.9	1.9
Total	100.0	100.0	100.0	100.0

APPENDIX D—Miscellaneous Crops

TABLE XLIV.

RETURNS FROM COTTON BY SYSTEMS OF TENURE, ACCORDING TO ACRES OF COTTON, ACADIA AND JEFFERSON DAVIS PARISHES, 1929.

Acres of Cotton	Wage Cotton	Cropper Cotton		Share Tenant Cot.	
	Owners Gross Return	Croppers Labor Return	Owners Gross Return	Tenants Gross Return	Owners Gross Return
0-5	$40	$26	$28	$33	$11
6-10	30	29	32	24	10
11-over	28	15	16	17	9

TABLE XLV.

YIELD OF SEED COTTON PER ACRE BY SYSTEMS OF TENURE, ACCORDING TO ACRES OF COTTON, ACADIA AND JEFFERSON DAVIS PARISHES, 1929.

Acres of Cotton	Owners		Croppers		Share Tenants	
	Average Number of Acres	Yield of Seed Cotton, Pounds	Average Number of Acres	Yield of Seed Cotton, Pounds	Average Number of Acres	Yield of Seed Cotton, Pounds
0–5........	3.15	526.05	3.10	799.70	3.00	912.00
6–10......	8.00	436.50	8.00	931.80	7.40	608.80
11–over..	22.00	395.80	34.14	460.60	28.30	449.30

TABLE XLVI.

ORGANIZATION AND INCOME OF FARMS GROWING LEGUME HAY AND ALL FARMS ACCORDING TO SIZE OF FARM, ACADIA AND JEFFERSON DAVIS PARISHES, 1929.

Acres of Rice	Total Number of Farms				Farms Having Legume Hay				
	Number of Farms	Average Rice Acreage	Average Yield per Acre, Bags	Average Labor Income	Number of Farms	Average Rice Acreage	Average Yield per Acre,Bags	Average Acres of Legumehay	Average Labor Income
0-100	22	75.3	9.8	$ 285	6	78.3	9.9	4.0	$ 123.50
101-200	51	154.2	11.2	1,379	9	157.8	11.5	6.5	1,232.70
201-300	29	249.0	10.9	2,016	5	250.0	10.7	13.8	2,095.80
301-over	22	385.6	10.3	3,096	5	400.0	10.1	27.2	2,607.50
All Farms	124	203.4	10.7	1,638	25				

APPENDIX E—Livestock

TABLE XLVII.

PER CENT INVESTMENT IN VARIOUS CLASSES OF LIVESTOCK, ACCORDING TO SIZE OF FARM, ACADIA AND JEFFERSON DAVIS PARISHES, 1929.

Acres of Rice per Farm	Number of Farms	—Per Cent Investment per Farm, Dollars— Work Stock	Cattle	Sheep	Hogs	Poultry	Total
0-100	22	46.6	39.7	0	6.3	7.4	100.0
101-200	51	30.5	57.6	2.5	3.0	6.4	100.0
201-300	29	34.0	53.1	.8	5.1	7.0	100.0
301-over	22	22.4	71.1	.6	2.8	3.1	100.0
All Farms	124	30.0	59.5	1.2	3.8	5.5	100.0

TABLE XLVIII.

ADDITION TO INCOME FROM CLASSES OF LIVESTOCK, ACADIA AND JEFFERSON DAVIS PARISHES, 1929.

Averages are for farmers keeping the class of livestock.

Acres of Rice	Number of Farms	—Addition to Income*— Cattle	Sheep	Hogs	Poultry
0-100	22	$101	$ 0	$24	$30
101-200	51	256	2	27	57
201-300	29	386	4	59	68
301-over	22	325	18	52	43

*Amount above purchases, losses in inventory and cost outlay for feed and veterinary.

Farmers not keeping livestock are as follows:

Acres of Rice	Number of Farms	Cattle	Sheep	Hogs	Poultry
0-100	22	0	21	1	0
101-200	51	2	49	14	0
201-300	29	2	26	10	1
301-over	22	0	20	3	0

TABLE XLIX.

INCOME FROM LIVESTOCK, RICE ACREAGE, AND LABOR INCOME, ACADIA AND JEFFERSON DAVIS PARISHES, 1929.

Income from Livestock*	Number of Farms	Average Income from Livestock	Acres of Rice per Farm	Yield per Acre, Bags	Average Labor Income
—$100–$ 50......	16	$ 4	200	10.4	$1,308
51– 200......	37	115	158	10.5	1,109
201– 350......	23	262	215	10.9	2,098
351– 500......	16	436	219	10.8	1,685
501– 1,100......	20	724	208	10.9	1,476

*Three farms with losses more than $100 and nine farms with incomes more than $1,100 omitted.

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Tractors and Trucks on Louisiana Rice Farms, 1929

(With Supplementary Data on Labor Requirements)

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TRACTORS AND TRUCKS ON LOUISIANA RICE FARMS, 1929

(With Supplementary Data on Labor Requirements)

by

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and
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Rice growing is one of the most highly mechanized types of farming in Southern agriculture. In Louisiana approximately fifty per cent of the tractors on farms are located in the four leading rice producing parishes of Acadia, Jefferson Davis, Vermilion and Calcasieu. According to the 1925 census there were about 1600 tractors on farms in these four parishes. Since 1925 tractor usage has increased in the rice area. Also, other types of farming are finding the new tractors better suited to their needs.

The intensive utilization of tractors and trucks in the rice area is made possible chiefly because of the high gross income per worker on rice farms. This fact is partly reflected in the higher wage rate prevailing there compared to nearby areas having different types of farming. When the outlay for man labor replaced is relatively high, a small number of workers replaced will result in a saving from wages sufficient to defray the expenses of owning and operating power machinery. Similar conditions in work stock replacement favored mechanical power usage.

The rice crop is well suited in its cultural requirements to the use of tractors. Some farmers use the tractor for every operation before the rice is flooded. Practically all the rice cutting is done with tractor power, and occasionally, if a long haul is involved, a farmer will use the tractor to haul bundle rice from the edge of the field to the thresher. The operations performed almost entirely by hand at the present time are shocking, pitching, sack sewing and dragging, and levee repairing. Attempts have been made to use the combine harvester in the rice area, but these have proven unsuccessful so far, due to moisture conditions in the rice grain, and the soil conditions at harvest time.[1] Repeated attempts will be made to introduce the combine as long as the price of rice encourages high labor incomes and the wage of labor remains at the present level. The use of a combine would increase further the volume of business which an individual operator could handle, providing he were able to make the necessary financial outlay.

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[1] Agricultural Engineering Report, March, 1928.

Data giving the proportion of motor trucks used by rice farmers are not available. However, the rice growers are probably using a higher percentage of the farm trucks of Louisiana than of the tractors. Apparently most of the larger rice growers find it more profitable to own trucks than to depend upon contract trucks or horses for their hauling. Trucks are especially suited to rice farming conditions because of the large tonnage to be handled. Even some of the small rice growers contract to have their seed rice, fertilizer, and market rice hauled rather than go to the expense of using a team or purchasing an old motor truck. Commercially operated trucks for hauling market rice are active in the area at harvest time.

Since the use of mobile power equipment has played such an important part in rice farming, many problems have naturally arisen relative to the desirability and economy of types of equipment for farmers handling different volumes of business. Much adjustment has taken place in the selection of the equipment for a given capacity of business, but the farmers' power problem is one of hastening this adjustment as much as possible, whether in the power unit or in the business done.

AIM OF INVESTIGATION

A study of the power problem was undertaken as a part of a farm organization study in the rice area in 1929. The aim of this investigation was to secure facts on power utilization and make them available for rice farmers, so that they might hasten their adjustment in power usage, and be able to choose more wisely in their future selection of different types of power for their needs. The main emphasis was placed on tractors and their usage because that problem seemed to be more difficult for farmers to solve. Especially was this true of the smaller farm units, and those farms not satisfactorily suited to the use of power units now available. Adjusting the acreage of rice to meet the needs of the power unit may be more difficult than an adjustment in power units to handle most economically the acreage available.

Data were secured only from actual operators of power machinery whose livelihood was secured chiefly from the farms they were operating, and those likely to become such users in the near future. This was believed by the investigators to give the situation as rice growers experience it. Errors of estimate are inevitable in a study of this type, but tend to be compensating in most instances. The farmer is the only one qualified to give the information desired for this type of study. Improved technique on the farmer's part in order to improve his estimate will add to the applicability of such results as are presented here.

DATA USED

The subject matter of this report deals with the data obtained from 124 rice farmers for 1929. These farmers were located in Wards Three, Four and Six of Acadia and Jefferson Davis Parishes. On 115 farms there were 181 tractors in use. Data concerning individual tractors were secured insofar as this was possible from the records and memory of each operator. Occasionally, when more than one tractor was kept, this was impossible as the outlay had not always been kept separated. Many rice farmers keep records of their major items of outlay. This is required for the purpose of securing loans. Some farmers use this material in getting comparative data on methods and practices being followed.

The items of information concerning tractors consisted of their age, new cost, estimated present worth, amount and cost of fuel, amount and cost of lubricating oil and cup grease, repair parts and labor, insurance, and depreciation. Similar information was obtained for trucks and cars used for farm business purposes. These types of mobile equipment required additional items for mileage, license, tires and tubes, and accident insurance. The cash outlay items were considered more significant than items of depreciation and present worth. Important farm organization factors are related to the mobile power problem in this report. Judgment must be used in the interpretation of the data presented. Many explanatory details are intentionally omitted because the writers have assumed an understanding by the reader of the methods and practices in the rice area.

Data were collected on all farms, irrespective of the age, make, and rating of tractors used. A number of these were comparatively obsolete, such as the Fordson, Avery, Sampson, Rumley, and Minneapolis. Some of these tractors are not built at the present time. Others are still on the market but with new and more acceptable models. In most instances the farmers, now depending on these old tractors for all or part of their tractor power, are anxious to get information on other makes prior to purchasing a new tractor. They are seriously considering a change in the near future and desire to get that type of tractor which will best fit their organization. Such information as contained in this report, it is believed, will give them accurate estimates concerning outlays and accomplishments for particular makes of tractors now prominently used.

So far as each farmer is concerned a tractor becomes inadequate when it fails to do the most difficult task normally expected of it. That means, in most instances, the land preparation work. A certain amount of tractor replacement has taken place. Many of these old tractors were replaced for part of the operations before their entire mechanical usefulness was consumed. Yet each year they are used a few days for discing, drilling, dragging, binding, or threshing. They serve a need for a part of an extra power unit, if we may refer to tractors in that sense. For that purpose they add more to the farmer's earnings than would be possible without them or with a mechanically new and complete power unit. This problem will be further discussed under choice of tractor.

PROBLEMS OF TRACTOR USAGE

Since tractor usage is increasing and replacement must frequently be made, the question of the proper type and rating of tractor to fit the organization is the most important problem in this connection. Knowledge of technical operation of mobile power equipment should be advanced with increased power usage. In purchasing, the question of efficiency of different makes of tractors using the fuels available at certain prices should be considered. In operating the tractor, the economy of using different fuels at their relative prices, plus the effect of such usage upon rate of accomplishment and depreciation is most important. Two important problems are worthy of consideration, and the solution of these may bring some increase in family earnings. One is the adjustment to a larger sized unit for those farmers now operating less than 100 acres of rice with a tractor; and the other is the improved usage of the tractor where a satisfactory acreage is maintained at present.

Farm land, classified as it is in the rice area, is in almost definite increases of forty acres and tends to group farms by quarter sections. This makes the farmers handle around 80 acres of rice, or 160, or 320, depending upon whether they own a quarter section, a half section, or a full section of land. The usual practice is to allow half of the land for rice to lay out each year. Since rice land either in use or resting actually occupies about 94 per cent of the total farm area, there is little opportunity to increase tractor usage if the rice area is too small. The best opportunity to increase the tractor usage is to rent additional rice land. If the rice area is too large, possibly land may be rented out temporarily. But the farmer finds it advisable to lose on his power utilization if he can more than make it up on his volume of business done.

Rice farmers should be acquainted with the mechanical operation of mobile power machinery. Next to business management, this problem is most important in getting low cost operation for the rice farmer. Investigations have shown beyond doubt that added usage and dependability of service are increased by adequate care in housing, greasing, and rate of operation. As a business fact, economies of this sort help the farmer by reducing the loss through unequal price levels for machinery bought and products sold, at a time when that spread appears to be decreasing.

While the above reference has been made to tractors and trucks, it is applicable to all the rice farm machinery. Other items such as binders, drills, grain separators, discs, and plows, have a high rate of depreciation which may be partially checked by careful handling. In the main such savings would be small, yet sufficient to justify some attention in management.

Problems of tractor usage and replacement will be considered in detail under the discussion of these particular phases. It is necessary to understand the particular farmer's problem when advising him what he should do in the light of experience of what other farmers are doing.

No partiality toward individual makes of tractors is intended in this report. The aim is to present the facts about tractor operation as the farmers interviewed have experienced them. If farmers have expressed a preference, then it has been considered desirable to express the preference here, in order that others may know the facts. Any preference beyond that is left to the interpretation which each reader may gain after considering the data presented.

DISTRIBUTION OF TRACTORS

Only nine farmers of the group studied did not own a tractor. The others had from one to four. Farmers having three or four tractors usually had a large one for threshing and a small one for very light draw bar work. A distribution of the farms according to the number of tractors owned or operated is given in Table I.

TABLE I.

DISTRIBUTION OF FARMS STUDIED ACCORDING TO THE NUMBER OF TRACTORS USED, ACADIA AND JEFFERSON DAVIS PARISHES, 1929.

Tractors per Farm	NUMBER OF FARMS Acadia Parish	Jefferson Davis Parish	Total Farms
0	7	2	9
1	31	31	62
2	18	23	41
3	7	3	10
4	1	1	2
Total	64	60	124

TABLE II.

DISTRIBUTION OF FARMS STUDIED ACCORDING TO ACRES OF RICE PER FARM, ACADIA AND JEFFERSON DAVIS PARISHES, 1929.

Acres of Rice per Farm	NUMBER OF FARMS Acadia Parish	Jefferson Davis Parish	Total
0-100	20	2	22
101-200	20	31	51
201-300	14	15	29
301-over	10	12	22
Total	64	60	124

Half of the farmers in this study had one, and ninety per cent had one or two tractors. The tendency towards a larger sized farm power unit in Jefferson Davis Parish is in keeping with the larger acreage of rice per farm (Table II).

The rice growers have agreed fairly definitely on two particular makes of tractors, the McCormick-Deering and the John Deere.

The use of the Wallis and the Case is gaining more favor in the area. The tendency seems to be towards a more powerful tractor, partly for the purpose of avoiding contract threshing. The Fordson and McCormick-Deering 10-20 do not have adequate power for threshing rice under normal weather conditions. However, the 1929 harvest season was extremely favorable in respect to weather. Sometimes the power of two small tractors is used to operate the thresher. The larger tractors will pull a three bottom plow, the tandem disc and harrow at one operation, or supply adequate power for threshing.

A distribution of the tractors according to make and rating is presented for Acadia and Jefferson Davis Parishes in Table III. It is interesting to note the localization of the Fordson and the John Deere. The size of farm business in Acadia Parish has been too small to justify in many instances a power outlay other than the Fordson. If farmers operating these small units expect to continue, they may expect very low incomes and poorly adjusted power units for their businesses. While some light may be thrown on merits of different tractors, the farmer, after considering available information, must choose that one which meets his individual need. Sixty-three per cent of those on the farms studied were either McCormick-Deering or John Deere.

TABLE III.

DISTRIBUTION OF TRACTORS BY MAKES ON RICE FARMS, 1929.

Make of Tractor	NUMBER OF TRACTORS Acadia Parish	Jefferson Davis Parish	Total
Fordson	20	5	25
McCormick-Deering 10-20	20	19	39
McCormick-Deering 15-30	16	16	32
John Deere 15-27	13	30	43
Hart-Parr*	7	0	7
Case*	8	3	11
Wallis*	3	8	11
Rumley*	3	5	8
Others*	1	4	5
Total	91	90	181

*Includes all sizes.

AGE AND ESTIMATED LIFE OF TRACTORS

The trend in the age distribution of tractors in use at a given time indicates in a general way the farmers' preference. It points to the adjustments which farmers are actually making in the size and make of tractors used. The age distribution for the tractors on rice farms studied in 1929 is presented in Table IV. The age of all tractors was secured. Tractors used for handling any part of the 1929 crop were classed as one year old. Those over five years were classified in a single group. Some of the older tractors were purchased second hand, and the exact age was not known by the present owner. In other instances the owner was not certain as to the time of purchase. These tractors were not classified for age. It is certain that few of them were less than five years old.

Accurate determination of the length of life of any tractor could be secured by keeping a large number of detailed performance records. Approximating from farmers' estimates we get a fairly good picture of this situation and one adequate for this purpose. The number of hours of draw bar and belt work is the best measure of length of life. Farmers owning new tractors had a tendency to estimate the tractor life relatively low. Yet as the tractors increased in age, estimates of life were increased, evidently influenced by the possibilities of extending life through intensive repairing. Tractors of a 10-20 horse-power rating, at an average age of 1.9 years, were estimated to last 4.9 years at a total performance of 3,200 hours. Those tractors being operated at six years of age were estimated to last eight years, with a total performance of 4,200 hours. Tractors of a 15-27 or 15-30 rating, at an average of 1.5 years, were estimated to last 6.1 years at a total performance of 4,100 hours. The average life of similar sized tractors at 5.7

TABLE IV.

PER CENT DISTRIBUTION BY AGE OF TRACTORS, ACCORDING TO MAKE AND RATING, ACADIA AND JEFFERSON DAVIS PARISHES, 1929.

Age of Tractors, Years	Make and Rating of Tractors					
	Fordson	McCormick-Deering 10–20	McCormick-Deering 15–30	John Deere 15–27	Other Tractors	Dominant Makes*
1	0	13	34	30	17	26
2	4	15	3	14	10	11
3	4	10	6	2	9	6
4	16	26	10	47	7	29
5	12	13	28	7	2	15
over 5	32	15	13	0	43	9
Not classified	32	8	6	0	12	4

*Includes McCormick-Deering 10-20, and 15-30, and John Deere 15-27.

years was estimated to be eight years, and the performance 5,400 hours. Only the outstanding makes have been included in these data.

Value depreciation tends to decrease with age and is highest during the first years of use. Conversely, repair outlays tend to increase at an increasing rate with age, at least until the main usefulness of the tractor is past. Outlays for repairs may more than offset depreciation, so the actual situation really combines original investment plus additions in the form of labor and parts throughout the life of the tractor.

Many of these old makes and models of tractors have remained in use on rice farms. A casual observer may comment on the cost of operating such obsolete equipment. Farmers buy tractors in years when the individual gross income from rice is largest. This means that considerable elasticity exists relative to the life of a tractor, because it can be repaired to run another season for a relatively smaller outlay than would be needed to make a new purchase. A new tractor is usually purchased before the entire mechanical usefulness of the old tractor disappears. These old tractors are used for very limited work long after they are unable to meet the demand of the heavier work, such as breaking. For these minor tasks the outlays are relatively economical, as we shall see in this discussion. The farmer makes his choice upon expected outlay to operate his old tractor as compared to the gross outlay for a new tractor to do about the same work.

Fuel and oil consumption may be higher for the old tractor than that required for a new machine of similar make and rating. Adequate power for performing all operations may be lacking. Little opportunity exists for keeping a sale price on second hand equipment. Sales agencies are always active in handling the new equipment. Thus, the resale opportunity is a negligible item in the farmer's calculation. Only current items of fuel, oil, repairs, and possible losses due to inefficiencies are involved. Due to the above conditions, such tractors successfully compete with the new tractors for certain operations, particularly on farms where the acreage of rice is poorly adjusted to a new power unit.

Old power units enable farmers to obtain a better adjustment when acreage is less flexible than tractor power. There are some farmers handling a rice acreage too large for one tractor and too small to use two good tractors. The old tractors are retained because their services add more to net income than would be possible if new tractors were to replace them. A good adjustment is required in order to keep the overhead outlay reduced to the most economical point.

ACRES OF RICE HANDLED

Nine farmers did not own a tractor. The average acreage of rice handled by them was seventy-three, and the average number of work stock kept was six. Four of the operators not owning a tractor were land owners, and the others were share tenants. Three of these land owners hired a tractor to assist in the preparation of the land for rice. Farmers using tractors handled larger acreages of rice as the size of their power unit increased. The number of acres handled by specific power units is presented in Table V, together with the work stock kept. The number of work stock per farm is influenced very little by the acres of rice handled, though larger farmers find it convenient to own enough teams to avoid much exchange labor. This is more important if they own and operate a threshing outfit. High land crops are cultivated almost entirely with work stock.

TABLE V.

AVERAGE ACREAGE OF RICE HANDLED AND WORK STOCK KEPT ON RICE FARMS ACCORDING TO POWER UNITS, ACADIA AND JEFFERSON DAVIS PARISHES, 1929.

Power Unit*	Number of Farms	Average Acres of Rice	Average Number of Work Stock
No Tractor	9	73	6.2
Fordson	9	100	5.1
McCormick-Deering 10-20	18	145	5.2
McCormick-Deering 15-30	10	213	8.0
John Deere 15-27	19	189	6.3

*Refers to farms using one tractor of the specified make and rating.

How well farmers have succeeded in getting the proper adjustment between power units and acres of rice may be seen in Table VI. This table indicates wide variations in the acres of rice handled by farmers using tractors of the same size. Obviously other influencing factors are essential in the organization obtained by each farmer at the present time. Some farmers are limited in land area and must be content to spread their outlay for tractors over a longer period of time. Others have more acreage than they may normally need for their power, but they prefer to apply their outlay for tractors more intensively. The latter condition is generally considered desirable for economical operation, chiefly because of the influence upon overhead outlay.

HOW TRACTOR TIME IS SPENT

A consistent uniformity exists in the degree of diversity of tractor usage for total time and for particular operations. The performance remains relatively the same irrespective of the make and rating of the tractors. For example the smaller tractors tend to put in about the same proportion of time between rice and other things, and on various rice operations, as appears from the operations of larger tractors. Of course exception must be made for individual tractors that do no draw bar work, or are used for long periods at relifting.

Ninety-six per cent of the total tractor usage is directly for the rice crop of the tractor owner. In Jefferson Davis Parish the remainder of the tractor time was entirely for contract threshing, while in Acadia this usage was equally employed at contract threshing and land preparation for other crops.

TABLE VI.

NUMBER OF FARMS HAVING SPECIFIED ACREAGES OF RICE ACCORDING TO THE POWER UNIT USED, ACADIA AND JEFFERSON DAVIS PARISHES, 1929.

	Number of Farms Having This Acreage of Rice					
Power Used*	0 to 125	126 to 175	176 to 225	226 to 275	276 and over	Total
No Tractor	8	1	0	0	0	9
Fordson	8	0	0	1	0	9
McCormick-Deering 10-20	8	7	2	0	1	18
McCormick-Deering 15-30	1	2	3	1	3	10
John Deere 15-27	3	7	4	3	2	19

*Refers to farms using one tractor of the specified make and rating.

The preparation of rice land for seeding requires about sixty per cent of the total tractor hours (Table VII). This consists of breaking the land, building the levees, discing, harrowing, and rolling. About 25 per cent of the time is employed in cutting and threshing rice. Tractor usage in seeding consists of the operations of drilling rice, pushing up levees, and harrowing and rolling after drilling. During the rice growing season tractors are used on some farms to drive the air pressure pump of the Diesel engine pumping plant, or to lift water for irrigation purposes.

The tasks just mentioned consist of both draw bar and belt operations. The bulk of the tractor work in the rice section, it will be recalled, is at the draw bar. Belt work consists of relifting and of threshing. Minor belt operations such as fanning seed rice, sawing wood, and grinding feed are performed only occasionally and need no further consideration here. How tractors of different makes, on which actual usage could be obtained, were employed relative to draw bar and belt work is presented in Table VIII.

The major opportunity which most farmers have of increasing their tractor hours is in the replacement of contract threshing. Fifty per cent of the farmers interviewed in Acadia Parish contracted for their threshing power and thirty per cent did so in Jefferson Davis Parish. The hired tractor work amounted to 5.17 per cent, and 2.19 per cent of the total tractor hours in the respective parishes, and was practically all for rice threshing. At the usual rate for threshing, quite a saving may be made, to apply on tractor operation, when the regular farm tractor is used in cooperation with one or two neighbors to handle their threshing.

TABLE VII.

PERCENTAGE DISTRIBUTION OF TRACTOR HOURS BY CLASSES OF WORK ON RICE FARMS, ACADIA AND JEFFERSON DAVIS PARISHES, 1929.

Class of Work	–Per Cent of Total Tractor Hours– Acadia Parish	Jefferson Davis Parish
Rice Land Preparation	61.1	61.1
Rice Seeding	5.9	7.1
Rice Growing	5.3	1.0
Rice Harvesting	23.7	26.6
Other Crops	2.0	.3
Outside Contract Work	2.0	3.9
Total	100.0	100.0

TABLE VIII.

AVERAGE HOURS OF WORK, AND PER CENT OF TIME ON BELT WORK, BY MAKES AND SIZES OF TRACTORS, ACADIA AND JEFFERSON DAVIS PARISHES, 1929.

Make and Rating of Tractor	Number of Tractors*	Total Hours per Tractor	Hours of Belt Work	Per cent of Belt Work
Fordson	22	380	0	0
McCormick-Deering 10-20	27	625	22	4
McCormick-Deering 15-30	21	679	83	12
John Deere 15-27	34	708	70	10
Wallis†	11	531	32	6
Case†	8	514	117	23
Hart-Parr†	6	347	102	29
Rumley†	4	90	75	83

*Tractors used on relifts and some of the minor makes not included.
†Includes all sizes.

The prevailing rates in 1929 were as follows:

	Rate per bag
Operators, engine, thresher and lubricants	$ .15
Operators, engine, thresher, fuel, and lubricants	.175
Operator and thresher	.10
Entire crew, including delivery to warehouse	.35

Thus, the farmer operating 150 acres and getting the average yield per acre would have to make a total outlay of $250 for threshing, of which $90 might be used to apply on additional tractor outlay. Obviously, ownership of a thresher is important, but many instances may now be found where three or four farmers own a thresher in partnership.

Only five farmers used their tractors for relifting purposes as well as other farm work. When a large acreage of rice is flooded from a tractor relift, the number of hours per tractor is increased markedly. In order to show this intensive usage, Table IX is given. The farmer using a tractor 1,668 hours handled 250 acres of rice and flooded 125 acres of it with a tractor. The farmer using a tractor 568 hours used it to help out on 125 acres. It is evident from these instances that an increase of thirty to fifty per cent in tractor hours is possible by using the tractor on the relift. The total outlay is low, but drainage ditches are not a reliable source of water in dry years.

Tractor work on crops other than rice is a minor factor as practiced at the present time. This condition seems to prevail irrespective of the acreage of other crops grown. In a few instances farmers prepared the land for crops with a tractor or used the tractor for putting in a legume hay crop. The difficulty is one of replacing sufficient men or teams permanently to justify the tractor. Except for the legume hay crop, the operations on other crops possible with a tractor all come at the time rice land is being prepared and planted. The rice enterprise gets first choice on all equipment, labor, and funds.

TABLE IX.

TOTAL TRACTOR HOURS, HOURS OF TRACTOR USE ON RELIFTS, AND OUTLAY FOR OPERATION, FIVE TRACTORS ON RICE FARMS, ACADIA AND JEFFERSON DAVIS PARISHES, 1929.

Make of Tractor	Total Hours Worked	Hours on Relifts	–Outlay per 10 Hours– Operating	Overhead
McCormick-Deering 10-20......	1,049	518	$2.21	$ .35
McCormick-Deering 15-30......	568	168	4.48	3.79
McCormick-Deering 15-30......	792	284	6.79	3.98
McCormick-Deering 15-30......	1,668	1,165	3.40	1.30
John Deere 15-27....................	1,511	660	2.69	1.93

MEN AND MULES REPLACED BY TRACTORS

In order to determine the comparative situation with respect to tractor use, each farmer interviewed was asked how many men and mules were replaced by his tractor. This was intended to reflect the alternative situation with respect to competitive power. For comparative purposes only the data for certain tractors have been used. This comparison refers to the number of men and mules, though significant facts are found concerning the rate of working, seed bed preparation, and the number of operations required.

The estimated displacement by farmers using one power unit was as follows:

Make of Tractor	Men Replaced	Mules Replaced
Fordson	1.2	6.9
McCormick-Deering 10-20	1.5	7.1
McCormick-Deering 15-30	2.1	11.6
John Deere 15-27	1.8	9.1

This displacement applies to tractors operated normal working time each day. A few farmers in the area used their tractors day and night for short periods to finish their land preparation and seeding.

For individual power units there is a dominant tendency for farmers to estimate the replacement higher, the larger the acreage of rice handled. Actually that is what happens when the better adjustment between power unit and acreage handled is attained. Yet between power units, the acreage handled for the same number of men and mules displaced varies widely. About the only way the farmer is able to judge this displacement is in terms of teams needed to handle his acreage, or the actual teams used before a tractor was purchased.

AVERAGE OUTLAY AND ACCOMPLISHMENT FOR TRACTORS

Outlay for the operation of a given make of tractor varies with the rate of accomplishment and mechanical condition of the machine. Again, the reader is cautioned against judging that a low cost of operation per day is most desirable. Frequently it is not, as in the case of larger tractors used for threshing purposes. Some farmers drive their tractors at a high rate of speed and accomplish more in a day. Other farmers do not get efficient operation even at a low daily fuel consumption. These individual variations need cause no alarm for they are to be expected and there is no way to eliminate them. Fuel outlays are influenced by the use of distillate instead of gasoline or kerosene. For 1929 the price of distillate was ten cents while gasoline was about sixteen cents per gallon. In the consumption of distillate the John Deere tractor is without doubt the most economical because of its mechanical construction.

Average outlay, as presented in Table X, does not include the wage of an operator. Regular hired men operate the tractor at the usual wage rate. Extreme items should be eliminated in arriving at averages. The satisfactory comparison is between outlays for a given amount of work. This is presented here as dollars for different expense items, and hours for time of work done. This may contain many misleading influences such as different prices for fuel, different working rates, and different mechanical condi-

TABLE X.

AVERAGE OUTLAY AND HOURS WORKED BY TRACTORS, EXCLUSIVE OF TRACTORS USED ON RELIFTS, ACADIA AND JEFFERSON DAVIS PARISHES, 1929.

Make of Tractor	Number of Tractors	Average Hours per Tractor	Outlay Per 10 Hours	
			Operating*	Overhead
Fordson	22	380	$5.38	$3.05
McCormick-Deering 10-20	27	625	4.16	3.66
McCormick-Deering 15-30	21	679	4.85	5.66
John Deere 15-27	34	708	4.44	4.20
Wallis†	11	531	5.26	6.87
Case†	8	514	9.13	7.85
Hart-Parr†	6	347	5.57	6.98
Rumley†	4	90	15.41	5.72

*Exclusive of operator.

†Includes all sizes and ages of tractors. Caution must be used when making comparisons between the last four groups of tractors and the others, because it was practically impossible to classify them for rating due to the small number in the total sample. However, many of these tractors were old and of a high rating and frequently not well suited to the size of farm. This accounts partly for the high outlays. Especially was this true for the Case tractors. Prospective tractor buyers should investigate carefully how the new models of these tractors are performing under rice farming conditions.

tions. Itemized statements are presented from which these averages were determined (Table XX to XXIII in Appendix A).

SPECIAL RICE EQUIPMENT

Grain drills, binders, and grain thresher are the most expensive items of machinery used in growing rice, other than power equipment. The grain drills have the fertilizer distributing attachment in most instances. Few farmers use a tractor for drawing the grain drill, though there is no special objection if a light tractor is available. Two types of grain binders are used; the power take-off binder, and the binder equipped to supply its own power by a bullwheel drive. The power take-off is an advantage in most seasons because the land gets mucky along the levees and causes considerable clogging unless continuous power can be supplied from the tractor to drive the binding mechanism. The power take-off binder costs about $325, or $50 more than the regular binder. Most of the threshing machines had either a twenty-eight or thirty-two inch cylinder.

The expected life of the items of equipment first mentioned depends upon service each year, power used to operate them, annual repair outlay, and exposure during the idle season. With increasing age, the loss from exposure tends to increase and service actually rendered is reduced. Thus farmers find these tools giving different lengths of service. This variation is typical of the estimation from farmers interviewed in this study. The average expectation was about 1,500 acres for a drill, 1,200 acres for a binder, and 30,000 bags for a thresher. The additional annual repair charge was approximately $20 for a drill, $40 for a binder, and $60 for a thresher.

THE POWER UNIT AND LABOR INCOME

Acres of rice handled is probably the best single indicator of expected earning for the farm family. This discussion has indicated that the power unit tends to vary with acreage of rice. To bring before the reader the possibilities which the writers believe to exist between the power unit and the labor income, the following discussion is included. Labor income is used here to give a measure of the farmer's return for efforts put in, after allowance has been made for keeping his capital intact. It is over and above that labor furnished by family help. Out of this amount the farmer must make new additions to business, maintain his family, and secure self and family improvements if possible. This maximum expectation as an average labor income may be quite definitely fixed in the case of rice farming by the size of power unit operated and the acres of rice handled.

In order to show what the average labor income was for farms of different sizes and using particular power units, all the farms having a similar tractor, or without tractors, were studied. While the number of farms are limited yet there is little doubt about the general situation represented with respect to labor income. The farmer operating without a tractor has lower outlays for production and he gets a low income. His volume of business is too small. The Fordson operator gets a larger volume of business, but his outlays increase almost as rapidly as gross income. The farmers using a single McCormick-Deering 10-20 tractor had an average labor income of $1,339 in 1929. They handled an average of 45 acres more rice and secured $1,031 higher incomes than did farmers operating with Fordsons. Farmers using a McCormick-Deering 15-30, or a John Deere 15-27 handled about fifty acres more rice and secured about $600 more labor income than did farmers operating with the smaller McCormick-Deering. The writers wish to emphasize the fact that a wide variation occurs and that farmers should realize this in trying to develop farm organizations that will return an amount sufficient to meet expectations possible with different power units in combination with given acreages of rice.

Not all organizations possess single power units like those just discussed. Some have more than one tractor and may include different makes. For the purpose of carrying out the same idea of expectation of income and volume of business done, more inclusive data are presented in Table XI. For this sample of farms the increase in labor income stopped at about 300 acres of rice and two tractors.

TABLE XI.

VARIATIONS IN LABOR INCOME AND ACRES OF RICE ACCORDING TO THE POWER UNIT USED, ACADIA AND JEFFERSON DAVIS PARISHES, 1929.

Size of Power Unit	Number of Farms	Average Acres of Rice	Average Labor Income
No Tractor	9	73	$ 417
One Small Tractor	28	128	982
One Large Tractor	35	188	1,775
Two Tractors—Large, Small	17	285	2,441
Two Large Tractors	21	289	2,092
More than Two Tractors	11	253	1,794

FARM MOTOR TRUCKS

Motor trucks have completely replaced work stock in hauling rough rice from the farm to the mill or warehouse. Few farmers have warehouse space, except for their seed rice, so that all the rice must be delivered as soon as harvested. The purchase of a motor truck is primarily for rice hauling and finds supplementary use in other hauling work. Hauling by truck saves time, and outlays needed for feed, shoeing, and other work stock outlays. Truck operators and those farmers hiring contract trucks are generally agreed that the savings due to trucks makes road hauling with mules a minor factor.

The adjustment problem with the individual farmer is one of choosing between hiring truck work done on a contract basis, and purchasing and operating his own truck. He is aided in arriving at a decision by considering outlays needed to own and operate a truck for the business which he has to do, and the contract outlays which he would have to make if he did not own a truck. This consideration extends even to the use of a car in the farm business. Some farmers completely replace the car for farm use by having a truck for all purposes, where previously the car had been used.

The chief operations performed by the truck are usually for the rice crop. Very few farmers do outside contract hauling, though some of them exchange with a neighbor. Sometimes a farmer will use his truck to haul tractor fuel and lubricating oil from market to the farm or from the farmstead to the section of the farm where it is needed. Most of the commercial oil companies operating in the rice area, however, deliver gasoline distillate, and lubricants to the farm for a very small additional charge.

There are many other tasks offering an opportunity to use the farm truck in addition to general business trips for the farmer. These consist of trips for seed and fertilizer for other crops, delivery of other crops to the market, hauling feed for livestock, and delivering livestock. These minor operations of the truck are comparatively insignificant in deciding on whether a truck should be purchased or not, but when a truck is added to the organization its use in diverse lines helps to add to the income prospects made possible by its investment.

An idea of the extent farmers have already placed trucks in their organization may be obtained from data presented in Table XII. Farms of 100 acres of rice or less are now using comparatively few trucks, which would seem to indicate that the hauling on farms of this size does not justify the investment in a truck. The proportion of farmers using trucks increased from 23 per cent on the smallest sized farms to 82 per cent on the largest sized farms. The ton and half truck was the maximum rating found. The optimum capacity for a farm truck is that sufficient to deliver

TABLE XII.

DISTRIBUTION OF MOTOR TRUCKS ON RICE FARMS, ACADIA AND JEFFERSON DAVIS PARISHES, 1929.

Acres of Rice	Number of Farms	Farms having Trucks	—Make and Rating of Trucks— Ford 1 Ton	Ford 1½ Ton	Chevrolet 1½ Ton
0-100	22	5	5	0	0
101-200	51	33	28	3	2
201-300	29	20	14	3	3
301-over	22	18	14	2	2

the rice to the warehouse about as rapidly as the capacity of the threshing outfit permits. Since rice hauling is usually given first importance in the consideration of a truck purchase, any capacity beyond that will probably be lost—a poor adjustment between the outlay for a truck and the volume of business for it to do. However, some farms have old trucks suitable for all jobs except heavy hauling.

The use of the truck in hauling rice to the shipping point or warehouse occupies sixty to seventy per cent of the truck use (Table XIII). Do not confuse the distribution of time on rice with total work done by trucks. Such details of time or mileage other than on the rice crop were not included in this study. However, total outlay for truck operation was obtained on the farms studied. Farmers not having trucks contracted to have their rice hauled to the warehouse. In 1929, of the total hours on rice, contract trucks performed 41.6 per cent in Acadia Parish, and 20.7 per cent in Jefferson Davis Parish. Hauling to market accounted for practically all of this.

Contract rice hauling is essential for many farmers. The contractors are in a position to move the rice quickly and, by getting a large volume, are able to get trucks with a capacity not possible by individual operators. The rate per bag varied from five cents to sixteen cents, depending on the length of haul and the kind of road. The most frequent rates were in the range of seven to ten cents. The average haul and the contract price per bag are given in Table XIV. It is necessary to remember that these data are for the specific farms studied. Most of these farms were located on or near gravel roads. For farms located farther from graveled roads the rates will be higher. There was little change in the contract rate as the distance increased from five to nine miles. Few farmers had over a nine-mile haul. While many

TABLE XIII.

PER CENT OF TIME BY OPERATIONS FOR OWNER OPERATED MOTOR TRUCKS, ACADIA AND JEFFERSON DAVIS PARISHES, 1929.

Operations	Per cent of Time on Rice Acadia Parish	Per cent of Time on Rice Jefferson Davis Parish
Haul Fertilizer and Seed	13.8	23.7
Haul Fuel	17.2	17.3
Haul to Market	69.0	59.0
Total	100.0	100.0

TABLE XIV.

VARIATIONS IN THE AVERAGE CONTRACT PRICE FOR RICE HAULING, ACCORDING TO DISTANCE FROM MARKET, ACADIA AND JEFFERSON DAVIS PARISHES, 1929.

Miles to Market	Number of Farms	Average Miles Hauled	Average Contract Price per Bag
4 or less	34	2.8	$.07
5 to 7	21	5.4	.10
7 to 9	6	7.2	.11
9 and over	5	10.7	.16

farmers lived farther than that from their trading center, their rice was hauled to a convenient railroad loading station. As the size of farms increase, the average haul to market tends to increase. The farmers contracting to have their rice hauled lived nearer their market than did the average farmer operating a similar rice acreage and hauling with his own truck. Obviously, length of haul is a factor in determining whether the ownership of a truck is economical or not. The spread in prices between size groups is hardly comparable with differences in distances.

An attempt was made to determine from the practices of the farmers the relation of volume of hauling and distance from market to the practice of hauling their own rice. In the two larger sized groups of farms there is a marked increase in distance from market as well as in the average number of bags to be hauled, on farms where hauling was done with the farm truck. Actually this was an average of about two miles longer haul and 175 more bags of rice. The farmer who had a longer haul owned a truck rather than pay a nine or ten-cent charge per bag. With the smaller farmers it seems to be a matter of indifference in the choice. Those hauling their own rice had slightly less to haul and were about the same distance from the market.

The average annual outlay for motor truck operation, exclusive of the driver, varied from $198 on farms having 100 acres or less of rice to $289 on farms having over 300 acres of rice. The chief difference in usage is in hauling seed rice, fertilizer, fuel, and market rice. On some farms the truck is used for all business errands instead of a car, or possibly no car is kept. In this study all the outlay for truck operation was considered a farm expense. A comparison is made here between the outlay for truck operation by farmers hauling their own rice to market and what the probable outlay for hauling market rice, seed, fuel, and fertilizer would be at contract rates. The contract hauler furnishes the truck operator. This item has not been included in the data on annual outlay. However, two men on the truck would represent an outlay of $4.00 per day, at 1929 harvest farm wage rates. This would mean at the maximum not over one and one-half cents per bag. From this data it appears that hauling over 2,100 bags at prevailing rates will about equal the annual outlay for the truck (Table XV). Less volume than this makes it necessary to use the truck for other crops and livestock needs.

TABLE XV.

ESTIMATED AVERAGE COST OF ROAD HAULING AT CONTRACT RATES AND OUTLAY FOR OWNER OPERATED TRUCKS, ACCORDING TO SIZE OF FARM, ACADIA AND JEFFERSON DAVIS PARISHES, 1929.

Acres of Rice per Farm	Cost of Hauling at Contract Prices			Average Annual Outlay for Truck Operation*
	Rice	Seed, Fertilizer and Fuel	Total	
0-100	$ 56	$ 16.90	$ 72.90	$188
101-200	161	39.39	200.39	226
201-300	245	51.82	296.82	280
301-over	387	121.27	508.27	299

*Exclusive of truck driver.

The distribution of the annual outlay on farms by size groups is presented in Table XVI. The relative amount expended for the various items on farms of different sizes is fairly consistent.

Two-thirds of the total outlay is for current operating expenses, and the balance is for estimated value depreciation and interest foregone by having funds so invested.

TABLE XVI.

DISTRIBUTION OF ITEMS OF OUTLAY IN THE OPERATION OF FORD TRUCKS ON RICE FARMS, ACADIA AND JEFFERSON DAVIS PARISHES, 1929.

Items of Outlay	ACRES OF RICE PER FARM 0 to 100	101 to 200	201 to 300	301 and over
Gasoline	$44.05	$53.80	$62.10	$76.87
Lubricants	11.14	17.93	20.11	16.85
Repair Parts	15.00	29.00	23.74	41.78
Repair Labor	5.00	1.27	2.06	2.22
Tires and Tubes	41.40	33.69	41.39	43.06
License	15.00	15.00	15.00	15.00
Insurance	.00	1.46	1.00	.00
Sub Total	131.59	152.15	165.40	195.78
Depreciation	54.00	62.00	79.83	66.94
Interest	12.56	17.19	17.85	25.87
Total Outlay	$198.15	$231.34	$263.08	$288.59

AUTOMOBILES FOR FARM USE

Fifty per cent of the automobiles on rice farms used partly or entirely for farm business were Fords. Seventeen per cent were Chevrolets. Operators of small sized farms estimated that they used their automobile 97 per cent of the time for farm business. Operators of farms 101 acres of rice or more indicated about 90 per cent of the total time and outlay was for farm use. Automobiles which were used entirely for the family or personal use of the operator were excluded. The instances of such usage were chiefly in the group of farms of over 300 acres of rice. Seven of the farmers maintained more than one car for farm use. This practice is usually associated with higher total outlay for automobiles and a lower per cent of the outlay for farm use.

The items of outlay for automobile operation on rice farms of different sizes are presented in Table XVII. Total outlay increased rapidly between the farms having less than 101 acres of rice, and those having over 100 acres. Interplay between truck use and car use for farm business becomes significant on larger farms.

WORK STOCK

The most important need for work stock on all rice farms is in hauling bundle rice from the field to the threshing machine. If this operation could be avoided in rice farming, there is little doubt that practically all work stock would be eliminated. Since work stock must be kept for that particular task, the problem of the farmer becomes one of using it at as many other jobs as may be worth while. He considers the outlay for doing the job with teams versus the outlay for a tractor. The farmer will, in all probability, keep his investment in both, so that current operating outlays and rates of accomplishment are the factors to be judged.

Most farmers hire additional teams for threshing. All of the late rice threshing is done in a relatively short time so that little opportunity exists for exchanging team work. Especially is this true when a farmer is doing contract threshing. Only 25 per cent of the farmers exchanged all their team work. Forty-two per cent of the smallest farmers traded, and only 18 per cent of the largest farmers. The extra team work was hired at $3.50 or $4.00 per day for man, team, and wagon.

TABLE XVII.

OUTLAY PER FARM FOR AUTOMOBILE OPERATION ON RICE FARMS OF DIFFERENT SIZES, ACADIA AND JEFFERSON DAVIS PARISHES, 1929.

Items of Outlay	ACRES OF RICE PER FARM			
	0 to 100	101 to 200	201 to 300	301 and over
Gasoline	$32.67	$73.04	$121.96	$113.50
Lubricants	10.61	17.64	22.87	19.72
Repair Parts	11.11	21.31	26.75	48.30
Repair Labor	.37	.46	....	2.50
Tires and Tubes	23.06	40.80	42.40	18.20
License	15.93	17.20	18.46	15.00
Insurance	1.56	1.23	1.90	....
Sub Total	95.31	171.68	234.34	217.22
Depreciation	57.25	101.37	128.75	83.60
Interest	18.58	29.90	30.04	28.55
Total Outlay	$171.14	$302.95	$393.13	$329.37

All of the farmers operating with only a Fordson did all or a part of their breaking with their teams. Many other farmers used teams for breaking the rice land because that operation comes at the time of year when the fresh rice stubble pasture is adequate to maintain the stock in good condition. Breaking is done in November and December so there is no rush to get the work done. Nearly all the farmers used work stock in drilling, usually because the tractors are busy just ahead of the drill, in discing and harrowing the land ready for seeding.

Over 90 per cent of the rice farmers purchased feed for work stock. This outlay averaged about $30 per head for all the farms. Home grown feeds which might have been sold or fed to other livestock on the farm amounted to $8.00 per head. The smallest farms had the lowest outlay for feed for work stock. The number of work stock kept increased less rapidly than acres of rice handled, so that the acres of rice per head increased from 15.2 on the smaller farms to 43.3 on the larger farms. Hours of work put in on rice increased from 361 per head to 531 on the same farms. Time put in by work stock on other things was not secured in this study. The acreage of other crops handled per head decreased as the acres of rice per farm increased. The smaller farms had an average of 4.5 acres of other crops per head and the larger farms 1.7 acres. Other crops included cotton, corn, soybeans, potatoes, and sweet potatoes. The practice among farmers who have croppers is to furnish each cropper with work stock for use throughout the crop season, so that a few head handle all the other crop work rather than all the work stock kept. Comparative data of a general nature are presented in Table XVIII.

The replacement factor is largely of historical significance to most farmers for the burden of work stock now kept is negligible in the operation of their businesses. It is highly improbable that they will increase their work stock in the near future, at present prices for mechanical power, and operating outlays such as fuel and oil, and wages. However, for that group of farmers where

TABLE XVIII.

OUTLAY AND ACCOMPLISHMENT FOR WORK STOCK ON RICE FARMS, ACADIA AND JEFFERSON DAVIS PARISHES, 1929.

Acres of Rice per Farm	Average Number of Head	Net Depreciation per Head	Feed Per Head		Acres of Rice per Head	Acres Other Crops per Head
			Purchased, Dollars	Home Grown,$*		
0-100	5.3	$10	$21	$ 5	15.2	4.3
101-200	5.4	7	34	8	32.9	3.3
201-300	8.8	3	32	8	33.3	2.3
301-over	10.0	2	30	10	43.3	2.7

*Does not include rice stubble pasture and rice straw.

no tractors are owned there is a possibility that comparisons will be significant for their future action. This comparison for farmers operating 0-100 acres of rice is presented in Table XIX. These data present the picture accurately, it is believed.

LABOR AND POWER REQUIREMENTS

The labor and power operations usually performed in producing rice have been grouped under four headings. These have been designated land preparation, seeding, growing, and harvesting. Land preparation consists chiefly of breaking the land, discing, and harrowing. Other minor preparation operations prior to seeding are draining and levee construction. Seeding includes the operation of seed cleaning and hauling, fertilizer hauling, drilling, and a few minor tasks performed after drilling and before the levees are closed for flooding. The requirements for growing include the operations of closing levees, walking levees, pumping, hauling fuel, weeding, and draining. Harvesting consists of the operations of cutting the swath, tieing, binding, shocking, and threshing. The usual order in which the operations occur, and the average hours for the 1929 crop are presented for farms of different sizes in Appendix D, Table XXVII.

TABLE XIX.

VARIATIONS BETWEEN OUTLAY AND ACCOMPLISHMENT FOR WORK STOCK ON FARMS HAVING 100 ACRES OF RICE OR LESS OPERATED WITH A TRACTOR, AND WITHOUT A TRACTOR, ACADIA AND JEFFERSON DAVIS PARISHES, 1929.

Items of Comparison	Farms operated with a Tractor	Farms operated without a Tractor
Average Number of Work Stock	5.0	6.2
Investment per Head in Work Stock	$68.00	$104.00
Depreciation per Head	$ 7.00	$22.00
Outlay for Purchased Feed per Head	$22.00	$21.00
Outlay in Home Grown Feed per Head	$6.00	$2.00
Acres of Rice per Farm	82.00	60.00
Acres of Rice per Head	17.30	10.00
Acres of Other Crops per Farm	5.20	2.70
Hours per Head on Rice	346.00	416.00

Some economies in labor and power are possible with larger acreages of rice. The most important savings appear in man labor for pumping, levee construction and supervision, and discing and harrowing. Variations occur due to soil and weather conditions, the topography and frequency of levees, the working rate of the power unit, and the time pressure for completing certain operations. Man labor is increased rapidly when horses are used instead of a tractor. Some individuals prefer to get their seed bed in better condition than others. Some farmers fail to keep subsequent operations together and find that they have to repeat these because of weather interference. Such variations are accepted as normal expectations and practically impossible to eliminate. The reader is cautioned against assuming fixed labor and power requirements. There may be many requirements which will result in a specific production.

A comparison has been made between single power units performing the same task. This represents as nearly comparable items as the data afforded. These comparisons have a worthwhile significance, if the supplementary information of individual farmers making up the compared groups is at hand. These data are presented in Appendix D, Tables XXX to XXXIII.

STATISTICAL APPENDIX

Much intermediate and general data were developed in the process of securing the specific data presented in the preceding discussion. It has been purposely intended to avoid placing excessive tabular material before the reader. But those especially interested in this subject may desire to get additional information from the original source material. The fundamental basis data are presented in Tables XX to XXXIII. It is the desire of the writers to make the comparative data available for the farmers who furnished it. It is believed that some facts are presented which will help farmers to act more quickly and judge more wisely in handling their power problems.

APPENDIX A—TRACTOR STATISTICS

TABLE XX.

REQUIREMENTS PER TEN HOURS FOR FORDSON TRACTORS, ACADIA AND JEFFERSON DAVIS PARISHES, 1929.

Farm No.	Hours Worked	Repairs	Fuel and Oils	——OUTLAY, DOLLARS——		
				Operating	Overhead	Total
48	100	$.50	$5.15	$5.65	$7.20	$12.85
60	100	1.10	3.07	4.17	8.60	12.77
60	100	1.10	3.07	4.17	5.60	9.77
33	100	....	3.08	3.08	5.80	8.88
49A	110	4.55	3.73	8.28	2.73	11.01
6	149	.47	2.28	4.36	7.51	11.87
38A	171	2.92	4.68	9.06	3.13	12.19
12	205	....	4.27	6.71	3.92	10.63
41	230	6.52	3.56	10.08	.35	10.43
37A	250	2.70	3.65	6.35	2.40	8.75
52	349	.43	2.59	3.31	5.48	8.79
8	350	1.71	3.64	7.06	3.79	10.85
19	463	1.08	2.79	4.41	....	4.41
59	483	1.15	2.42	3.57	2.36	5.93
14	530	4.90	1.78	6.68	.11	6.79
13	568	.18	2.16	2.34	1.48	3.82
16	570	.70	2.02	2.72	1.71	4.43
5A	592	2.36	2.97	5.51	2.02	7.53
17*	680	1.23	3.07	5.53	.96	6.49
39	889	1.69	2.12	4.15	.06	4.21

*Average for three tractors.

TABLE XXI.

REQUIREMENTS PER TEN HOURS FOR McCORMICK-DEERING 10-20 TRACTORS, ACADIA AND JEFFERSON DAVIS PARISHES, 1929.

Farm No.	Hours Worked	Repairs	Fuel and Oils	OUTLAY, DOLLARS		
				Operating	Overhead	Total
63	275	$......	$3.76	$3.76	$8.73	$12.49
7	317	4.89	3.81	8.36	5.80	14.16
10A	367	1.09	3.75	4.84	2.81	7.65
53	385	2.34	4.16	6.50	4.99	11.49
53	385	3.90	4.16	8.06	4.27	12.33
20A	405	....	3.12	3.12	5.73	8.85
6A	408	1.47	5.09	6.81	4.51	11.32
55	469	.64	3.63	4.48	4.13	8.61
15	484	.08	1.87	1.95	3.50	5.45
32	491	1.53	2.42	3.95	2.73	6.68
55A	514	.74	1.89	2.63	4.66	7.29
53A	592	2.15	2.49	4.94	2.87	7.81
58	612	1.06	3.29	4.35	2.36	6.71
50A	617	2.03	3.24	4.43	.52	4.95
30A	638	....	3.48	3.48	3.84	7.32
45*	658	1.90	2.30	4.20	3.28	7.48
40	715	.03	2.41	2.44	3.91	6.35
16A	727	1.03	2.55	3.75	2.25	6.00
1	761	....	4.05	4.05	3.94	7.99
35A	785	.38	2.65	3.08	1.63	4.71
3A	850	....	2.07	2.07	4.24	6.31
47A	855	....	1.94	1.94	5.33	7.27
48A	878	1.14	3.01	4.15	3.32	7.47
21A	916	1.64	1.76	3.62	1.96	5.58
12A	1049	.24	1.92	2.21	.35	2.56
60A	1055	.99	2.69	3.68	1.61	5.29
22A	1065	.23	3.15	3.43	2.54	5.97

*Average for two tractors.

TABLE XXII.

REQUIREMENTS PER TEN HOURS FOR McCORMICK-DEERING 15-30 TRACTORS, ACADIA AND JEFFERSON DAVIS PARISHES, 1929.

Farm No.	Hours Worked	Repairs	Fuel and Oils	OUTLAY, DOLLARS		
				Operating	Overhead	Total
64	140	$........	$2.43	$2.43	$19.11	$21.54
23A	153	....	4.38	4.38	19.87	24.25
36	230	....	3.69	3.69	21.74	25.43
11A	530	....	5.35	5.35	6.44	11.79
56	568	....	4.48	4.48	3.79	8.27
49A	590	2.54	4.24	6.78	4.58	11.36
57	614	3.26	5.28	8.54	4.38	12.92
36A	624	2.54	2.75	4.24	1.97	6.21
59A	666	.09	2.47	3.32	2.94	6.26
59A	666	.09	2.47	3.32	2.94	6.26
42A	667	.37	6.08	6.45	4.20	10.65
57A	696	3.59	3.33	6.92	.35	7.27
48	731	.88	3.14	4.02	3.67	7.69
48	731	.73	3.14	3.87	3.67	7.54
10	740	.68	4.32	5.00	1.35	6.35
13A	760	.20	6.49	6.69	3.58	10.27
23A	760	1.97	5.27	7.24	3.95	11.19
1	761	....	4.05	4.05	3.94	7.99
38	792	.02	6.75	6.79	3.98	10.77
16A	838	.24	2.74	3.04	1.96	5.00
60A	1055	1.43	3.52	4.95	....	4.95
31A	1067	....	2.75	2.75	3.75	6.50
15A	1135	....	4.77	4.77	4.37	9.14
37	1668	.04	3.36	3.40	1.30	4.70

TABLE XXIII.

REQUIREMENTS PER TEN HOURS FOR JOHN DEERE 15-27 TRACTORS, ACADIA AND JEFFERSON DAVIS PARISHES, 1929.

Farm No.	Hours Worked	Repairs	Fuel and Oils	OUTLAY, DOLLARS		
				Operating	Overhead	Total
8	150	$........	$2.84	$2.84	$13.33	$16.17
24	274	....	5.03	5.03	13.72	18.75
56A	358	2.88	3.75	7.99	5.56	13.55
19A	396	....	2.96	2.96	5.09	8.05
7A	410	.98	4.18	5.53	4.59	10.12
11A	411	3.65	5.29	9.67	6.23	15.90
52A	416	1.69	2.25	3.94	5.77	9.71
61	426	....	2.70	2.70	6.43	9.13
28A	454	.11	4.04	4.15	8.63	12.78
2A	507	1.48	3.28	4.76	5.56	10.32
18A	560	4.11	5.25	9.36	.50	9.86
33	560	.89	2.01	2.90	3.78	6.68
26A	585	.02	3.39	3.41	3.38	6.79
2A	587	.30	3.25	3.67	5.21	8.88
25A	591	1.86	3.37	5.23	2.91	8.14
43A	640	.63	2.90	3.53	3.19	6.72
23	652	.63	4.62	5.28	3.80	9.08
32A	669	1.39	1.68	3.07	2.66	5.73
9A	705	.17	5.47	5.64	2.30	7.94
20	720	....	2.67	2.67	4.15	6.82
27A	757	....	2.51	2.51	2.70	5.21
64	782	1.28	2.13	3.41	3.27	6.68
42A	787	.64	5.98	6.62	2.49	9.11
57A	823	1.82	2.95	4.77	1.85	6.62
44A	847	....	3.49	3.49	4.17	7.66
41A	873	.04	6.74	6.78	2.43	9.21
51	947	....	3.95	4.27	2.98	7.25
46A	1084	2.31	2.39	4.70	1.66	6.36
17A	1093	....	3.27	3.27	3.65	6.92
48A	1095	.95	2.99	3.94	2.63	6.57
37A	1180	.03	2.30	2.72	2.03	4.75
46A	1204	2.08	2.45	4.53	1.49	6.02
58A	1226	.08	1.98	2.06	2.22	4.28
24	1310	.57	3.01	3.67	2.52	6.19
49	1511	.40	2.19	2.69	1.93	4.62

APPENDIX B—MOTOR TRUCK STATISTICS

TABLE XXIV.

PER CENT DISTRIBUTION OF ITEMS OF OUTLAY FOR FORD TRUCK OPERATION ON RICE FARMS, BY SIZE OF FARM, ACADIA AND JEFFERSON DAVIS PARISHES, 1929.

Items of Outlay	ACRES OF RICE PER FARM 0 to 100	101 to 200	201 to 300	301 and over
Gasoline	22.24	23.26	23.61	26.64
Lubricants	5.62	7.75	7.64	5.84
Tires and Tubes	20.89	14.56	15.74	14.92
Repair Parts	7.57	12.54	9.02	14.47
Repair Labor	2.52	.55	.78	.77
License	7.57	6.48	5.70	5.20
Insurance	.00	.63	.38	.00
Sub-Total	66.41	65.77	62.87	67.84
Depreciation	27.25	26.80	30.34	23.20
Interest	6.34	7.43	6.79	8.96
Total	100.00	100.00	100.00	100.00

TABLE XXV.

COMPARISON OF THE USE OF CONTRACT TRUCKS AND OWNED TRUCKS ON RICE FARMS, ACADIA AND JEFFERSON DAVIS PARISHES, 1929.

Acres of Rice per Farm	Contract Haul Average Miles to Market	Contract Haul Average Bags per Farm	Average Price per Bag	Own Haul Average Miles to Market	Own Haul Average Bags per Farm
0-100	4.2	749	$.08	4.8	710
101-200	5.2	1704	.09	4.7	1688
201-300	3.3	2501	.09	5.5	2723
301-over	4.5	3745	.10	6.2	3878

APPENDIX C—AUTOMOBILE STATISTICS

TABLE XXVI.

PERCENTAGE DISTRIBUTION OF OUTLAY ITEMS PER FARM FOR AUTOMOBILE OPERATION ON RICE FARMS OF DIFFERENT SIZES, ACADIA AND JEFFERSON DAVIS PARISHES, 1929.

Items of Outlay	ACRES OF RICE PER FARM			
	0 to 100	101 to 200	201 to 300	301 and over
Gasoline	19.09	24.11	31.02	34.46
Lubricants	6.20	5.82	5.82	5.99
Repair Parts	6.49	7.03	6.80	14.66
Repair Labor	.22	.15	....	.76
Tires and Tubes	13.47	13.47	10.79	5.53
License	9.31	5.68	4.70	4.55
Insurance	.91	.41	.48	....
Sub-Total	55.69	56.67	59.61	65.95
Depreciation	33.45	33.46	32.75	25.38
Interest	10.86	9.87	7.64	8.67
Total Outlay	100.00	100.00	100.00	100.00

TABLE XXVII.

AVERAGE LABOR AND POWER REQUIREMENTS BY OPERATION FOR 100 ACRES OF RICE, ACCORDING TO SIZE OF FARM, ACADIA AND JEFFERSON DAVIS PARISHES, 1929.

OPERATION	SIZE OF FARM															
	0–100 ACRES				101–200 ACRES				201–300 ACRES				301–OVER ACRES			
	Man Hours	Horse Hours	Tractor Hours	Truck Hours	Man Hours	Horse Hours	Tractor Hours	Truck Hours	Man Hours	Horse Hours	Tractor Hours	Truck Hours	Man Hours	Horse Hours	Tractor Hours	Truck Hours
Cleaning ditches	23	4	..	..	35	8	1	..	11	..	2	..	22	2	..	..
Breaking	268	778	42	..	141	210	87	..	148	189	97	..	172	293	99	..
Levee construction	23	46	4	..	29	18	12	..	23	7	10	..	17	..	9	..
Draining	38	81	..	..	20	37	..	..	32	59	..	..	30	66	..	..
Discing and harrowing	323	356	192	..	184	110	154	..	179	12	176	..	150	34	141	..
TOTAL PREPARATION	675	1265	238	..	409	383	254	..	393	267	285	..	391	395	249	..
Haul fertilizer	1	3	..	..	9	4	..	6	9	7	..	5	9	..	..	8
Haul and clean seed	16	19	..	4	16	13	1	6	11	3	1	5	15	..	3	7
Seeding	92	367	..	..	85	310	8	..	84	310	5	..	77	307	..	..
Harrow and drag	12	40	2	..	7	12	4	..	3	6	2	..	..	..	..	..
Levee construction	69	71	20	..	49	45	21	..	64	47	24	..	54	37	22	..
Draining	27	44	3	..	15	27	..	..	25	45	..	..	25	32	..	..
TOTAL SEEDING	217	544	25	4	181	411	34	12	196	418	32	10	180	376	25	15
Close levees	90	..	..	..	58	8	..	..	67	15	..	..	61	..	..	..
Levee walking	897	..	..	..	530	..	..	..	486	..	..	..	392	..	..	..
Weeding	292	..	..	..	208	..	..	..	249	..	..	..	261	..	..	..
Draining	100	..	..	..	56	..		..	57	..	..	..	50	..	..	..
TOTAL GROWING—No Diesel Engine	1379	..	..	..	852	8	..	..	859	15	..	..	764	..	..	..
Close levees	86	..	14	..	71	6	..	..	81	9	..	..	58	10	..	..
Levee walking	545	..	..	..	586	..	..	..	430	..	..	..	323	..	..	..
Run engine or haul fuel	505	29	..	18	908	201	21	19	734	5	31	14	516	..	..	30
Weeding	469	..	..	..	275	..	..	..	264	..	..	..	141	..	..	..
Draining	69	..	..	..	80	..	..	..	66	..	..	..	54	..	..	..
TOTAL GROWING—Diesel Engine	1674	29	14	18	1920	207	21	19	1575	14	31	14	1092	10	..	30
Cut swath and tie	45	..	..	..	31	..	..	..	38	..	..	..	19	..	..	..
Binding	209	171	81	..	168	9	82	..	176	24	86	..	178	18	79	..
Shock	346	..	..	..	313	..	..	..	347	..	..	..	330	..	..	..
Pitch	162	..	..	..	174	..	..	..	181	..	..	..	167	..	..	..
Haul to thresh	312	618	..	..	341	682	..	..	352	699	..	..	329	645	7	..
Thresh	58	..	39	..	65	..	38	..	57	..	40	..	55	..	33	..
Sew	33	..	..	..	37	..	..	..	38	..	..	..	33	..	..	..
Drag and clean	65	..	..	..	75	..	..	..	79	..	..	..	67	..	..	..
Haul to market	72	..	..	52	88	..	..	55	90	..	..	52	88	..	..	48
TOTAL HARVESTING	1302	789	120	52	1292	691	120	55	1358	723	126	52	1266	663	119	48
TOTAL—Using Diesel Engine	3868	2627	397	74	3802	1692	429	86	3522	1422	474	76	2929	1444	393	93
TOTAL—Not Using Diesel Eng.	3573	2598	383	56	2734	1493	408	67	2806	1423	443	62	2601	1434	393	63
ACRES	1,513				6,966				5,332				5,533			

TABLE XXVIII.

TOTAL LABOR ON RICE ON FARMS HAVING DIFFERENT POWER UNITS, ACADIA AND JEFFERSON DAVIS PARISHES, 1929.

Power Unit	Number of Farms	Hours per 100 Acres of Rice			
		Man	Horse	Tractor	Truck
No Tractor	7	3403	4524	82	29
Fordson	10	4095	2905	545	97
McCormick-Deering 10-20	15	3161	1732	450	63
McCormick-Deering 15-30	7	3290	1665	415	68
John Deere 15-27	16	3002	1324	387	79
Other Tractors	7	2694	1483	539	76

TABLE XXIX.

TOTAL LAND PREPARATION LABOR ON FARMS USING DIFFERENT POWER UNITS, ACADIA AND JEFFERSON DAVIS PARISHES, 1929.

Power Unit*	Number of Farms	Hours of Labor per 100 Acres of Rice		
		Man	Horse	Tractor
No Tractor	7	773	2715	37
Fordson	10	764	1539	331
McCormick-Deering 10-20	15	408	380	271
McCormick-Deering 15-30	7	379	269	246
John Deere 15-27	16	377	264	242
Other Tractors	7	391	420	243

*Refers to one tractor of the specified make and rating.

TABLE XXX.

LABOR REQUIREMENTS FOR BREAKING RICE LAND IN ACADIA AND JEFFERSON DAVIS PARISHES, 1929.

Power Unit*	Number of Farms	Average Acreage of Rice	—Hours per 100 Acres—		
			Man	Horse	Tractor
Team Only	7	73	268	1000	....
Fordson	10	100	231	793	38
McCormick-Deering 10-20	15	130	163	279	92
McCormick-Deering 15-30	8	194	146	200	94
John Deere 15-27	16	190	137	193	87
Other Tractors	7	139	153	307	75

*Refers to 3 or 4-horse hitch, or one tractor of the make and rating given.

TABLE XXXI.

LABOR REQUIREMENTS FOR HARROWING AND DISCING ON RICE FARMS, ACADIA AND JEFFERSON DAVIS PARISHES, 1929.

Power Unit*	Number of Farms	Acreage of Rice	Hours per 100 Acres		
			Man	Horse	Tractor
No Tractor	7	73	424	1527	37
Fordson	10	100	439	614	286
McCormick-Deering 10-20	15	130	182	62	166
McCormick-Deering 15-30	8	194	151	......	150
John Deere 15-27	16	190	167	15	162
Other Tractors	7	139	187	76	167

*Refers to 3 or 4-horse hitch, or one tractor of the make and rating given.

TABLE XXXII.

LABOR REQUIREMENTS FOR DRILLING RICE ON FARMS IN ACADIA AND JEFFERSON DAVIS PARISHES, 1929.

Power Unit*	Number of Farms	Acreage of Rice	Hours per 100 Acres		
			Man	Horse	Tractor
No Tractor	7	73	90	361	......
Fordson	10	100	116	463	......
McCormick-Deering 10-20	15	130	88	335	3
McCormick-Deering 15-30	8	194	90	339	......
John Deere 15-27	16	190	82	325	......
Other Tractors	7	139	82	326	......

*Refers to 3 or 4-horse hitch, or one tractor of the make and rating given.

TABLE XXXIII.

LABOR REQUIREMENTS FOR CUTTING RICE ON FARMS IN ACADIA AND JEFFERSON DAVIS PARISHES, 1929.

Power Unit*	Number of Farms	Average Acreage of Rice	Hours per 100 Acres		
			Man	Horse	Tractor
Teams Only	7	73	144	475	11
Fordson	10	100	292	119	131
McCormick-Deering 10-20	15	128	180	......	89
McCormick-Deering 15-30	8	194	166	34	79
John Deere 15-27	16	190	161	14	76
Other Tractors	7	139	166	......	83

*Refers to 3 or 4-horse hitch, or one tractor of the make and rating given.

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Financing Production and Marketing of Louisiana Strawberries and Suggested Reorganization

BY

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AND
AGRICULTURAL AND MECHANICAL COLLEGE
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A Brief Analysis of Present Practices And a Suggested Re-organization in Financing The Production and Marketing Louisiana Strawberries.

BY

R. L. THOMPSON, Research Economist

INTRODUCTION

The Louisiana Strawberry Industry has experienced during its existence violent fluctuations both in acreage production, and prices. When weather conditions have been favorable for Louisiana and adverse in the states to the north and east, farmers of Louisiana have been able to experience fair returns. On the other hand, when droughts keep down plant production and late frosts retard early shipments of berries, many farmers find themselves heavily in debt and often find it necessary to produce the succeeding crop by use of credit.

The latter condition has prevailed during the past two seasons, and as a result, farmers of the strawberry area are experiencing the poorest economic conditions that have prevailed in the industry for years. Possibly they have never experienced such conditions in the past. Supply and cash credits have become so important during the past few years, that a large per cent of the farmers feel that it is impossible to produce a crop unless some agency supplies all the ready cash and supplies necessary to carry out the farm program.

The relatively short crop coupled with low prices received for the bulk of the berry crop of the Spring of 1930, left farmers, as well as some associations* and other agencies concerned, heavily in debt. This condition has made it difficult for these agencies to

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[1] Mr. M. J. Voorhies, of the Extension Division of the Louisiana State University and Agricultural and Mechanical College assisted with the field work of this project. Thanks are due the managers of the three central selling organizations for their cooperation in this study, also the heads of the various local associations and other leaders in the area.

*The term association is applied to all those organizations in the berry area, whether private, corporate, or cooperative in nature, that look after the marketing of berries, and supply credits for production purposes.

secure a line of credit with which to meet the needs of farm groups. This lack of available credit has caused leaders in the area to seek outside assistance. The Federal Farm Board was appealed to for aid in financing the production operations for the 1930-31 season.

The information desired by the Federal Farm Board upon which it could base its action was not available. A number of questions came up that could not be answered intelligently due to a lack of assembled facts. This condition, along with the desire to help the industry get on a sounder basis by pointing out the weaknesses and suggesting improvements, led to this study.

It is desired that all available facts be presented in such a manner that the masses in the area covered will be able to understand them, and to formulate a program that will help farmers to help themselves through cooperative activities.

This analysis proposes to bring out facts that will answer the following questions: 1—Is the berry crop handled consistently from year to year to the best interest of the producer? 2—Are farmers justified in supporting the numerous organizations through which they obtain supplies, and market their crops? 3—Are buyers able to come together on the Auction and hold prices down irrespective of market demands? 4—Does the type of refrigerator car in which berries are loaded have anything to do with the prices paid for berries? 5—Is there a relationship between the carrying qualities of berries and the type of refrigerator car used? 6—What are the possible advantages in closer cooperation among the berry growers? 7—What can be done and how can the farmer be helped to help himself?

Ways and means of bringing about this cooperative organization are presented in the appendix of this bulletin.

BRIEF HISTORICAL SKETCH OF THE DEVELOPMENT OF THE STRAWBERRY INDUSTRY IN LOUISIANA

According to some of the oldest residents in the berry area, David Manard settled in Tangipahoa Parish, near Tickfaw, in 1861 and introduced strawberries as a commercial crop. The Civil War interrupted the development for several years. In 1867 Mr. Manard

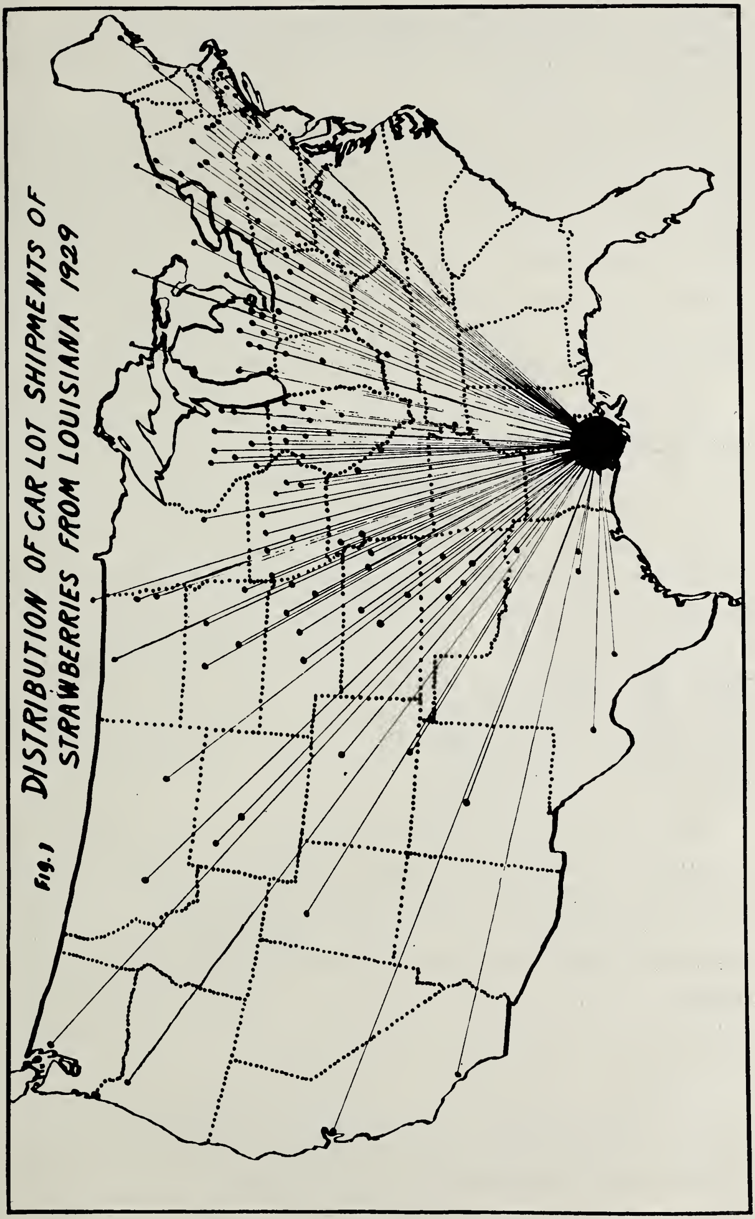

Fig. 1 DISTRIBUTION OF CAR LOT SHIPMENTS OF STRAWBERRIES FROM LOUISIANA 1929

returned to his farm and was joined in berry production by the following families: Stevens, Bucks, Calmes, Casons, Cunninghams, Stricklands and Hucks.

It was in 1876, according to Harry D. Wilson, that his father, Dr. W. D. Wilson, planted two acres of strawberry plants near Independence, Louisiana. This was the beginning of the commercial strawberry industry at this point. Two years later Mr. Ben Huck of New Orleans put in extensive plantings. Berry production expanded to a point where strawberries are the source of relatively large incomes to farmers of five parishes of the State, namely; Tangipahoa, Livingston, St. Helena, St. Tammany and Ascension.

Until about the middle of the nineties it was necessary to plant both pistillate and staminate plants, usually two rows of pistillate, and one of staminate. This assured proper pollenization and well formed fruit. Through the work of Mr. Bob Cloud of Independence, Louisiana, the Klondike plant was developed by crossing certain imported pistillate plants with Miller seedlings and the Huffman berry.[1] This Klondike berry came in as the main commercial plant in 1901. Mr. Cloud entered into contract with a few of his neighbors who obtained some of the early plants, not to sell or give away any of these plants for five years. However, they spread rapidly to other points in the area and are still grown almost exclusively in the berry belt of Louisiana.

One of the early problems of strawberry growers was to get the product to market in a salable condition. Refrigeration was not known to the industry and great care was necessary in fertilization and handling to be able to place the product on the Chicago market, the only market for a number of years, in a consumable condition. Bone meal was thought to be the only fertilizer that could be used to produce a hard firm berry. This resulted in bone meal being used extensively in the berry belt.

In the early nineties, pony refrigerators were introduced and these were used to convey berries to Chicago Commission Merchants, to hotels, and to restaurants.

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[1] Information obtained from Mr. H. B. Ray, Ponchatoula, Louisiana.

The American Express Company extended its services over southern lines of the Illinois Central in 1893. Ten refrigerator cars were provided by the Merchants' Dispatch Transportation Company in 1896. These were the first cars of farm produce to be moved by passenger train service. Refrigerator car service expanded in proportion to the expansion of the berry industry. In 1903 sixty refrigerator cars were in service. Chicago was the principal market up to that time. By the end of 1915 there were 336 refrigerator cars delivering fresh strawberries to eighty-seven different cities distributed over twenty-nine states, and points in Canada.[2] The 1929 season found available refrigerator cars numbering into the thousands, and distributing fresh berries in car lots to 134 different city markets in thirty-five states and several points in Canada. (Fig. 1). Strawberries bring in annually from five to eight million dollars to farmers of the area.

The second problem with which the producer was confronted, was the problem of selling. Farmers delivered their crops to the railroad station and consigned them to commission houses. This practice was carried on independently until 1898. Freight rates were high on less than carlot shipments, and some of the commission men at the central markets were unscrupulous in their dealings with farmers. The farmers at Ponchatoula were the first to recognize the evils of the system that then prevailed, and first to come together in an associated way to load in car lots. The first local association was formed at Ponchatoula in 1898. Through concerted effort Ponchatoula farmers received on an average from thirty to fifty cents per crate more for berries than did farmers at other local shipping points. Ponchatoula farmers established contact with Mr. E. G. Davies, a commission merchant in Chicago, and consigned all cars to him for several years. Mr. Davies distributed the berries to different jobbers throughout the city, and in turn rebated to the local association the advantages of car lot rates. Commissions of 10 per cent were charged by the Central receiver, and the refunds amounted to about five cents per crate. Concerted action on the part of berry growers stimulated more efficient express service, and the berry industry expanded to wider areas.

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[2] Beckner, W. E.—Illinois Central Magazine, April 1916, pages 39-46.

It was in 1909 and succeeding years that ushered in farm associations at the main shipping points in the area. Delhonde and Ripp organized the first association at Independence. This was in 1907. The following year Joe Duhuono was placed at the head of this association. He circularized every important market in the country, making it known to the buyers the berry production that could be expected the following year. This attracted buyers to Independence in large numbers, and resulted in the establishment of the "Strawberry Deal" in the berry area. That is, consignment methods gave way to F. O. B. sales.

Following the organization at Independence, farmers at Hammond, Amite, Tickfaw, and Albany organized into local selling units. There were no relationships established between these local associations that were binding. The Independence association sent men into the markets to learn conditions, and keep the local leaders informed as to supply and price. Local buyers desiring to buy car lot quantities would approach the Independence sales agency and get prices. If Independence offered berries for $2.50 per crate, which was in line with market prices, buyers would go to other points and ask for prices. Organizations at other points would quote prices at $2.50 on information obtained from Independence. Due to lack of close coordination between association leaders buyers were able to play one association against the other and force prices down from that point previously established by market conditions. Competition between organizations reduced prices below fair prices. This practice continued for several seasons. Eventually, Independence and Ponchatoula inaugurated a kind of auction sale, that is they sold berries to the highest bidder. This worked very nicely until the local broker came into being. The broker bought all berries with the understanding that the price be fixed at that price paid for the first car sold over the block at auction. The auctioneer found out what was happening and instituted a program of destroying the broker. This resulted in dropping the first car at the first bid offered. Often the first car was sold from a dollar to a dollar and a half less than the market justified. This caused much dissatisfaction on the part of the growers who were selling to the local brokers. Throughout the early years of the industry, competition between local units resulted in grief to the producer.

The auction method disappeared about the beginning of the World War, and wire sales were resorted to. In 1923, cooperation was encouraged through the Farm Bureau activities. The same year the Hammond Auction was inaugurated by Mr. Weinberger. The auction method of sales has proven satisfactory in a measure, and is still used. Two or three auctions have been maintained in Hammond since 1924. The auction as it is operated today has a distinct advantage over the early type that was used. Today all berries, with few exceptions are sold at auction. The broker as well as the association employs the auction method. This prevents a certain amount of competition between local units, and their activities do not unduly depress prices.

There are two auctions in the Hammond district that are operating at present, and these handled approximately 98 per cent of the berries shipped out of the area last season. The Louisiana Farm Bureau Selling Exchange maintains an office at Baton Rouge and by wire sales handles the berries that are delivered to it. Last season this organization handled forty cars of berries and its prices compared favorably with prices obtained on the Hammond Auction.

TREND IN BERRY PRODUCTION IN THE EARLY PRODUCING AREA

Berry acreage in Louisiana has expanded from a few acres along the Illinois Central Railroad in the early nineties to several thousand acres, extending both east and west from the main lines of the Illinois Central Railroad. In 1918 there were approximately 5,000 acres planted to berries. There was a slight decline in acreage for the 1919 season, but the area expanded to 14,600 acres by 1924. The 1925 season experienced a considerable decrease in acreage, dropping to 10,340 due to the unfavorable season for plant production during the summer of 1924, and the unfavorable conditions for getting plants out during the fall months. Since 1925 the area has been on the increase, reaching a total of 24,600 acres by 1930.

Other early states, Alabama, Mississippi, Florida, and Texas, have experienced a similar increase in strawberry acreage. These

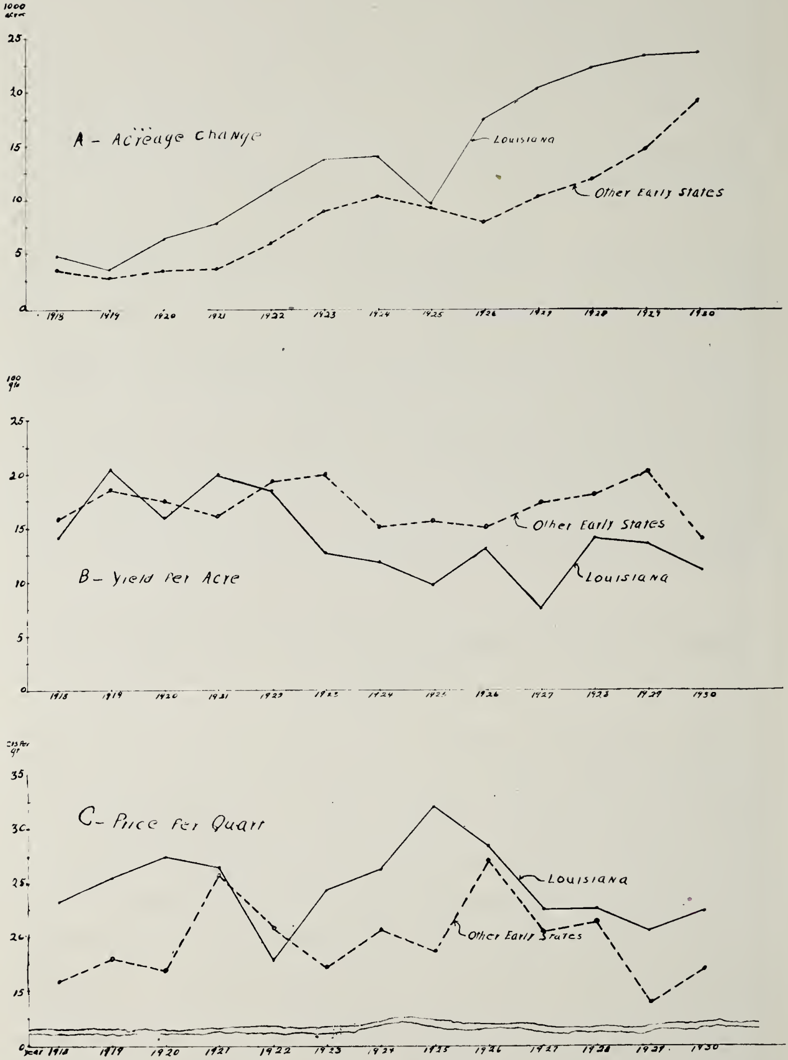

Figure 2: A—Strawberry acreage changes in Louisiana and other early states from 1918 to 1930. B—Average yield per acre in quarts for Louisiana and other early states from 1918 to 1930. C—Average seasonal price per quart for strawberries produced in Louisiana and other early states from 1918 to 1930.

states combined planted 3,880 acres to berries in 1918 and reached 10,910 acres by 1924. During the 1925 and 1926 seasons the trend was downward; the acreage dropping to 8,240 in 1926. Since that time, the swing has been upward, reaching a maximum of 18,300 acres by 1930. Fig. 2, Plate A, shows the acreage changes in Louisiana and in the other early states since 1918.

YIELD PER ACRE

Due to the limited acreage that can be planted and managed by one man and his family, yield per acre is an important consideration. Fig. 2, Plate B, shows a distinct downward trend in yield per acre. Yields are governed to a great extent by weather conditions and cannot be controlled by cultural practices entirely. However, good cultural practices show decided results on yields. Some good farmers are able to harvest much heavier yields than are indicated by the chart. General low yields per acre are responsible in a measure for the plight of Louisiana berry growers. They are confronted with more and more competition from the early states. Alabama, especially, is becoming a strong competitor. Yields per acre have been considerably higher in Alabama than in Louisiana. The Chart gives a comparison of acreage yield for Louisiana with that of other early states over a period of thirteen years. Alabama and Florida have averaged approximately 21 per cent higher in yield per acre than has Louisiana. The average yields being 1,812 and 1,443 quarts respectively. The other early states have relatively low yields. The best cultural practices must be employed by all Louisiana berry farmers if they wish to hold the lead in the early berry area.

BERRY PRICES

Louisiana berries bring a higher price per quart than is paid for berries in competitive states. Only one time in thirteen years has the price of berries as a seasonal average been higher in the neighboring states, and that was in 1922. The average seasonal prices for Louisiana and other early states are shown in Fig. 2, Plate C. Louisiana berries have averaged above twenty-three cents per quart during eight of the thirteen years under consideration.

Of the five years in which twenty-three cents or less were received as an average, four of these were the last preceding seasons. If one can judge from the economic conditions that prevail in the berry area, Louisiana berry production is not profitable when the price averages twenty-three cents or less. The advantages that are maintained in price differences are primarily due to the type of package put on the market and the fact that the Louisiana area is favorably located with respect to transportation facilities, that is, time from the central markets.

The statement is often heard that Louisiana has a partial monopoly on the berry markets of the country due to the early season. This statement is partly true when weather conditions are favorable and a large harvest can be had before April 1st. However, when cold weather retards the season as was the case in 1930, Louisiana meets with much competition. Alabama, Arkansas, Tennessee, and North Carolina became heavy shippers of berries before Louisiana completed the season. These four states shipped approximately 3,000 cars of berries during the forty-five days, April 1st to May 15th while Louisiana was shipping heavily. These cars were distributed throughout the period as indicated in Fig. 3. Apparently Louisiana producers under such circumstances would find it advantageous to get out of the market earlier, and divert their berries to cold-pack plants or some other outlet. This station is doing some work to find a profitable outlet for berries that are harvested near the end of the season.

CHANGES IN MARKETING ORGANIZATIONS

That the marketing organization has evolved from a very small unit back in 1898 has already been indicated. Since this date associations have been organized at all shipping points in the area. Back in 1908 or 1909, each shipping point had one organization. As the industry expanded and new leadership sprang up, farmers withdrew from the old associations and organized new units. With very few exceptions, there has never been a true cooperative spirit prevailing in the area and these exceptions have been confined to rather restricted areas, and to relatively few individuals within the

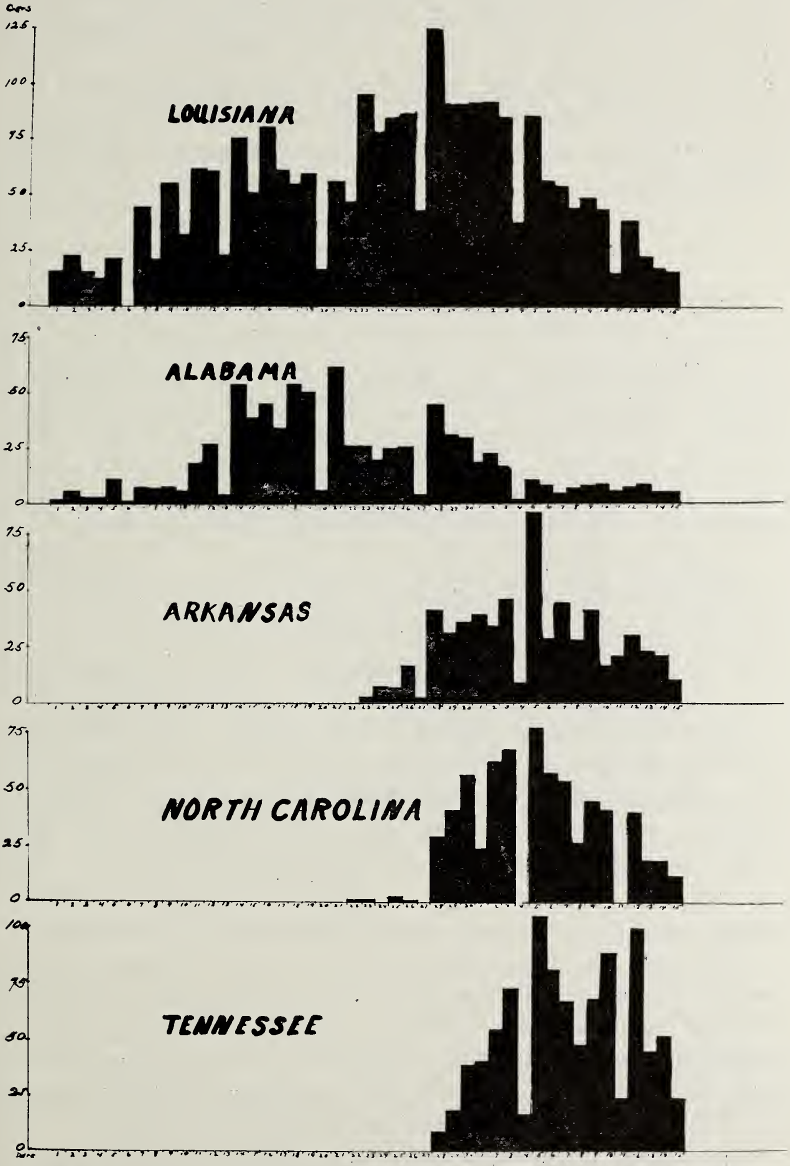

Figure 3: Daily carlot shipments of strawberries by states from April 1st to May 15th, 1930.

area. Today there are forty-two local associations; twenty-four of these are brokers operating under the name of specific associations. The remaining eighteen have hired managers and take on the nature of cooperative associations. Only three or four can be classified as pure cooperative associations. One of the big evils in the marketing system of the area is the excessive number of these associations that are maintained.

USES OF CREDIT IN THE BERRY AREA

Berry growers were introduced to the credit system, that now prevails, in 1910. Brokers throughout the area, in order to get a better claim on the farmers' business, as well as to promote larger business, made credits available to growers in the form of supplies and cash. In many cases credits were not needed, but farmers felt that it was safer from a personal standpoint to operate on the other man's capital than it was to operate on his own. Consequently, many used credits who could have otherwise done without them.

It was in 1923 that wholesale uses of credit were introduced. Mr. Charles Weinberger, who was a man of considerable means, came into the territory, put into operation the auction as we now know it, and encouraged berry production. Credit practices were stimulated, and heavy losses were experienced by some of the leaders, who were eager to help the berry growers. The needs for credits in the form of supplies and cash have been increasing up to the present time. This past season 85 per cent of the berry producers used credits obtained from the local associations. The demand for credit for the 1931 season is even greater than it was last year, and many farmers are unable to secure a line of credit because some of the associations have been placed in a weakened condition, and their credit rating has been impaired. The past two seasons have left the associations with large carry-overs of unpaid loans due to the farmers' inability to meet their obligations. The associations, as a rule, meet their obligations to the banks and other financing agencies, but the position of some is weak and this makes it difficult to secure cash and supplies to advance to farmers.

The trouble which the farmers are having in securing credit, the short crops, and the relatively low prices for the product, is causing a degree of unrest, and it is showing itself in the demands for a revision of the present system.

LOCAL ASSOCIATIONS IN THE BERRY BELT

It has been suggested that the so called associations take on many forms; some are private brokers who deal with groups of farmers, others are made up of groups of farmers and business men who hire a manager. These organizations usually are incorporated and carry small capital stock. This stock is owned by a few farmers and business men, farmers owing a very small share of the total. These associations deal with several hundred farmers, sell supplies, advance cash, and handle the crop through the marketing channels. Every patron pays the same price for supplies and service, but the profits or losses are absorbed by the stock holders. A third type of association exists in the territory. This type we might call cooperative. All patrons of the organization are members, a hired manager is maintained, and every member shares in the profits or losses which occur to the body. These organizations are usually without capital stock and operate for mutual benefit. For the sake of convenience, all organizations will be referred to as associations in the succeeding pages of this analysis.

In an effort to find out the present status of these associations, a survey was made during the summer of 1930. An effort was made to get records from the entire group of forty-two associations. Twenty-eight of the forty-two found it possible to cooperate in the study. Eleven of these were outright brokers and the remainder maintained a degree of cooperation.

There were 6,144 farmers represented by the twenty-eight associations, averaging 220 men to the organization in 1930. In 1929 the average number of farmers per association was 228, and in 1928 it was 246. There has been an increase in the number of associations out of proportion to the increase in number of berry farmers: thus the decrease in number of farmers per association.

These associations sold on the average 40,125 crates of number 1 berries during the spring of 1930, or a total of 1,123,500 crates. These sold for $2,941,316.00, an average of $2.61 per crate. Average prices for the same associations reporting for 1929 and 1928 seasons were $2.39 and $3.12 respectively.

Not all associations were able to report 1928 and 1929 business, some of these were not in existence, others had no records from which information could be had.

The increasing number of associations in the area is promoting inefficiency in the operation of the local businesses. Amite, Independence, Hammond, and Ponchatoula, have too many individual units. The same is true at other points where dissension has been the sole cause for additional organizations. Leaders do an injustice to the farmer when they promote organizations to duplicate work of existing organizations. Farmers should recognize this fact and be reluctant in giving up an established organization for one that has not been tried, unless there is a possibility of additional service from the new organization.

The following frequency distribution will give one a picture of the size of the organization unit based on volume of berries handled in 1930.

VOLUME OF BUSINESS PER ASSOCIATION

Number of Crates	Number of Associations
Less—20,000	5
20,000—30,000	6
30,000—40,000	7
40,000—50,000	2
50,000—60,000	3
60,000—70,000	1
70,000—80,000	0
80,000—90,000	2
90,000—and over	2

It will be noted in this table that there were five associations in the group operating on a volume less than 20,000 crates; and in the class in which most of the associations fall, there is a volume of only 30,000 to 40,000 crates, or between forty-five and fifty cars. There are four associations in this group that handled 80,000 crates or more last season. This approaches a volume that will justify keeping paid secretarial and office help. The small volumes require proportionately too much overhead, and the actual cost per crate handled is excessive when consideration is given to services rendered. The tendency seems to be toward the smaller unit, as has been pointed out. Not only the number of men per association is decreasing, but the average volume of business, as well as the lower range of volume handled. In other words, there is not that adjustment toward what is thought to be the ideal unit. The following data give an indication as to what has happened during the past three years in this respect.

TABLE I

Range and Average Volume for Associations in Louisiana, 1928-1930

Year	Range in Number of Crates	Average Number of Crates per Association
1928	23,887 to 129,248	70,645
1929	12,083 to 117,907	55,991
1930	8,341 to 100,728	40,125

STATUS OF LOCAL ASSOCIATIONS

Apparently there is little relationship between the volume of business an organization handles and the average price that is received for the product. However, there is a variation in average prices from association to association.

The prevailing charge collected from farmers by the associations, both private and cooperative, is ten cents per crate. For this dime, the local association keeps records for the group as to crates, fertilizer, seed and the loading of berries on cars at harvest time. The association assumes no responsibility after the berries are inspected and loaded, except to collect the checks from the auction and distribute them to the growers or to their accounts. There is an additional service rendered by the local associations. They furnish cash and supplies to the membership where it is necessary. There is a charge on each of the two items to pay expenses, and in some cases an excessive price is charged because the farmer cannot get the service elsewhere. Very few of the associations show a profit at the end of the year, and fewer rebate to the membership that which has been made. The twenty-eight associations reporting for 1930 season were paid $104,770.00 as a charge against handling the berries. Some few associations handle the business for five cents per crate, some seven cents, but most of them charge ten cents. This crate charge amounted to 3.6 per cent of the value of the sales of berries. Apparently, there is a chance for unusual profits for the associations. However, due to the small size of business units, the heavy overhead, and the failure to collect from the farmers their outstanding obligations, associations experience very small profits.

The average income from crate charge is $3,741.00 for each association. The total expenses, on the average, for each association, including salaries, wages, telephone, telegraph, stationery, etc., amounted to $4,911.00. The average salary and labor bill was $3,826.00 and in addition, thirteen associations reported losses amounting to an average of $2,727.00, and the carry-over, that is the amount on books that was not paid by farmers out of 1930 crop, by twenty-seven associations averaged $10,122.40. The farmers of one association paid up in full. Total credits advanced by these twenty-eight associations amounted to $1,114,891.00. Of this amount, $430,518.00 was cash advances the remainder consisted of fertilizer, seed, and crates. The carry-over amounted to 24.5 per cent of all credits advanced. Losses that were marked off the books amounted to 3.2 per cent of total credits.

The advances made by the various associations cover expenses for vegetable crops as well as for berries. Expenses experienced by these associations also include truck expenses. The total expenses amounted to 73.4 per cent of all money received by associations for handling charges. This leaves 26.6 per cent for the association. In addition, farmers paid on the cash loans $45,088 in interest, which amounts to 10.4 per cent as a flat charge. The associations paid from eight per cent to 14 per cent discount rate on what money they borrowed, and most of them borrowed the full amount used. This means that the farmer got a flat rate that was just about equivalent to the time rate paid by the association. Several association records indicated a loss on the interest account. In some cases managers anticipated the rate at eight per cent and agreed to carry borrowers at six per cent flat rate, and later found that the agencies from whom the association intended borrowing moved the rate to twelve per cent and fourteen per cent discount. This made it impossible for associations to come out ahead on the interest account.

Thirteen of the associations were able to discount their paper with banks and other agencies at the rate of 8 per cent, one at 9 per cent, four at 10 per cent, two at 12 per cent, and two at 14 per cent. These were discount rates and actually amounted to a range in interest rates from 8.6 per cent to 16.2 per cent. It would seem that the interest rate is entirely out of line when we consider the rate of interest that is paid on the money market, and too, when the ability of the farm enterprise to pay is taken into consideration. No one denies the fact that agriculture cannot continue to pay such rates and succeed. The state usury law does not control the rate of interest, neither is it expected that it should. Money is like other commodities in a sense. If there are excessive loanable funds seeking employment, the interest rate will adjust itself to where these funds will be used. On the other hand, if there is a lack of sufficient loanable funds, the interest rate will rise to that point where the maximum income is obtainable. The risk element is a factor in interest rates. The greater the risk, the higher the rate must be to offset the danger of losses. Another factor that is a strong determinant is the monopoly element that prevails in the area. The sources of credit, as the farmer sees it, are very limited, and it becomes a matter of using the money at the high rate or do without. The question of interest rates is purely a relative matter. A fifteen per cent rate is not high if the money can be used in such a way that better combinations of the productive factors can be secured, and the returns are sufficiently great to pay this rate. On the other hand, four per cent is a high rate when losses are incurred. The good business man will refuse to use money at rates that will bring losses to his enterprise. This matter should be looked upon in the same light as buying machinery or any other capital goods. If it will not result in net returns to the enterprise, the machine should not be purchased. Money should not be borrowed if it will not result in net returns to the business, except for unusual circumstances, as preservation of health and holding things together over short depressions.

Not only do farmers pay high prices for cash credits, but in most cases they pay unnecessarily big margins on supplies. For the twenty-eight associations reporting, farmers paid in margins on fertilizer, a total of $21,506.00. These margins ranged from $1.00 per ton with some of the cooperative associations, to 20 per cent on the list price for private associations. Fertilizer companies allowed 10 per cent discount for cash in most instances. This made it possible for associations with cash to buy fertilizer for $90.00 which were sold to farmers for $120.00, making a profit on cash outlay of 33⅓ per cent. Generally these associations used borrowed money to purchase the fertilizer, and this cost them from 8.6 per cent to 16.2 per cent. Under such circumstances it was not profitable for organizations to borrow money with which to get the benefit of the 10 per cent discount allowed by fertilizer companies.

These same associations reported a margin of $19,640.00 on crates, crate prices ranging from twenty-four cents to thirty-five cents each. This indicates that there is a wide variation in margins charged on crates by different associations. Some reported no charge except when crates had to be stored, and then only the expenses of storage were charged. Other associations charged 20 per cent on list price, the prevailing charge was three cents per crate. Only $1,298.00 was reported as profits on other commodities such as seed, insecticides and the like. The total income for all associations in the area amounted to $215,280.00, this includes crate charges $104,770.00, margins on fertilizer, $26,181.00, crates $22,913.00, seed $4,032.00, and interest collected, $57,384.00. The expenses of operation were; salary, and wages, $107,154.00, miscellaneous expenses $36,200.00 and interest paid, assuming eight months to be the time the loans were used, $56,302.00. These items totaled $199,656.00, leaving a paper profit of $15,624.00. A picture of this situation for the past three years is shown in Table II.

TABLE II

Statement of Average Outlay and Average Receipts for Louisiana Farm Associations in Berry Area, for 1928-29-30

	EXPENSES				INCOME				
Year	Wage Salary	Misc.	Int. Chg.	Total Exp.	Cratage Chg.	Marg. on Supplies	Int. Paid	Total Income	Diff.
1928	5410	1026	2164	8600	5962	2189	1194	9345	745
1929	4998	514	2085	7597	5264	2357	1684	9305	1708
1930	3826	1085	2049	6960	3741	1753	2012	7506	546

Average losses reported for each of the preceding years are: 1928, $988.00 for those reporting losses, of which there were five; 1929, $1,747.00, ten reported losses; 1930, $2,727.00, thirteen reported losses.

Average losses for those reporting increased rapidly over the past three seasons. The necessity for carrying on their books heavy obligations for the membership, seems to be growing more important. The average carry-over for 1928 was $4,944.00, only six associations reporting a carry-over. In 1929, twenty associations reported carry-overs averaging $6,205.00, and in 1930, twenty-seven of the twenty-eight associations reported their carry-overs as averaging $10,122.00. Some of these figures are cumulative, but in most cases men who owe the association at the end of the season are able to get very little credit during the succeeding year, and many times this group is able to pay up in full the following year, and it is the so called good risk that falls behind the following year. Apparently, the majority failed to pay up in full during the 1930 season, since only 75 per cent of the credits granted were repaid.

There is no question but what the association heads are responsible in a large measure for the conditions as they now exist. In the first place, they feel that it is good business to get a large number of members, since every crate of fruit delivered to the association means an income of 10 cents and every ton of fertilizer sold has promises of profits, so it is with empty crates. As a result of this desire for business, keen competition sets in between the associations at the various shipping points. There are from two to seven of these units at all the important shipping points. This competition causes managers to be too lax in their credit policies. They do not know the business of the men they serve. As evidence of this fact, managers of twenty-eight associations were asked to list the number of acres of berries planted by its membership for the 1930 season. Eight of these managers could not even guess at the acreage. They stated that they had no idea; ten others were frank to say that they did not know, but were willing to make an estimate; while the remainder could give fairly accurate information, as they had records on every man who obtained credit from them, and were in close touch with the rest of the membership. One reason for this apparent laxity is probably due to the fact that the other fellow's money is being used to conduct the business. The average amount of money borrowed by these associations was $32,330.00 in cash. The amount of credits in the form of boxes and fertilizer is not available. The total credit advanced was approximately $50,-

000.00 per association, including supplies and cash. The average amount of cash on hand at the end of the 1929 season was $4,013.00. When cash and supply credits are combined they probably approach 90 per cent of the total funds the association handled during the season of 1930.

These associations must be handled efficiently and along business lines the same as any banking or mercantile business if they are to render a real service to the farm group. Lax credits and policies will prove disastrous to not only the institutions, but to the farmers patronizing them.

In giving these averages, it is not the purpose to condemn all associations. Some are being manned by efficient managers, and are succeeding in a splendid way. This cannot be said of the majority however.

The following table summarizes the general conditions for the associations for the past three years.

TABLE III

Status of Average Conditions for Twenty-eight Local Associations For 1928-29-30

	1928	1929	1930
Average No. men per association	245	228	219
Per cent men using credit	80	86	85
Average No. acres berries per man	4	3.9	4.6
Average amount credit extended by ass'n	$48,890	$39,619	$39,817
Average value property owned by ass'n	$9,033	$10,294	$8,635
Average capital stock for stock ass'ns	$14,540	$14,555	$14,565
Average No. crates No. 1 berries sold	70,645	55,991	40,125
Average value of berries sold per ass'n	$213,200	$134,279	$105,047
Average price received for berries	$3.01	$2.39	$2.61
Average amount borrowed by ass'n	$44,797	$32,832	$32,330
Av. amt. cash on hand at end of season	$5,737	$4,013	$3,678
Per cent local ass'n charge is of total value	2.8	4.1	3.6
Per cent carry-over is of total credit	6.1	14.9	24.5
Per cent loss is of total credit	1.0	2.1	3.2
Per cent auction charge is of total value	2.2	3.3	2.8

The above summary gives a picture of trends for the past three years. The trend is downward in most of the items. The fact is very noticeable in number of men per association, average number crates sold, average borrowings, available cash on hand at end of season, and value of berries sold. A slight upward trend is noticeable in per cent of men using credit, average carry-over, and losses. The only conclusion that one can draw from the above data, is that these associations are finding themselves in a more precarious position as time goes on.

There is a wide variation in the system of record keeping as one moves from association to association. In some cases, trained bookkeepers are employed, and all records are kept up to date, and reliable information can be had from these associations. Other records are kept in the most haphazard way, and many items cannot be obtained due to lack of records. For any manager to be able to interpret his business in the proper way, he must have complete records of all transactions and these systematised in such a way that they can be interpreted. It is highly desirable that men who are in charge of this work, adopt a system of accounting that will aid them in determining exactly the status of the business at all times.

Several associations in the berry area have gone a step farther in serving their membership than that of looking after the loading and selling of the product, and advancing cash and major farm items. These associations have gone into the retail mercantile business. This is getting into another field of service entirely and should not be a part of the work of the association. There is danger of this phase of the work becoming a burden, and handicapping the other work for which the associations are organized. Apparently, these associations are making a success of the retail business. However, there are specialized agencies already in this field and until these agencies become so inefficient that cooperation and cooperative effort can surpass them, it is advisable to stay out of such activities. If there be a tendency to enter this field of activity it could well be kept as a separate and distinct enterprise.

FINANCING THE BERRY INDUSTRY

It has been pointed out already that about 85 per cent of the farmers in the berry area depend upon credits in some form on which to operate. The number seeking credit for the 1931 season will exceed 90 per cent of all farmers in the berry business.

On the basis of information obtained from twenty-eight of the associations in the area, approximately $1,810,000 worth of credit was supplied by the associations in 1929-30. Information is not available for advances made by banks, merchants and other agencies. However, in 1928, banks supplied credit to 27.7 per cent of the berry farmers, the loans averaging $344.02, a total of $762,304. Merchants advanced credit to 41.9 per cent of the berry growers in 1928, the average account being $431.53. These accounts amounted to $1,444,712. There is every reason to believe that bank credit to individual berry growers has decreased very much within the past two years. Merchants have had a tendency to decrease the amount of their advances to farmers, both agencies leaving it to the local associations to take care of the credit needs of their membership. If bank and merchant credit be reduced by 50 per cent from the 1928 figures, which is purely an estimate, the total credits extended by these three agencies for 1930 amounted to $2,913,000. This is a conservative estimate of credits used in the area. Individuals supply some credit, and when we take into account all sources of credit, the total amount used will approximate $3,000,000. The berry crop sold for $4,475,232. This leaves a difference of $1,475,232. The auction deducted from this value $120,159 for selling service, the local associations deducted $157,122 for services rendered, the interest charge on cash amounted to approximately $86,000. This makes a total deduction of $363,339, leaving approximately one million dollars to be distributed among farmers of the area. Out of this must come taxes, upkeep, and the like. There are approximately ten thousand berry farmers in the entire area. This leaves a relatively small sum per farmer. However, many farmers have other enterprises, and the income from these is not listed. These data are presented to show that the berry industry is capable of paying its way even under unfavorable conditions as were experienced last season. These averages mean little from the individual farmers' standpoint. There are many individuals who are able to make a much better showing than the average. There are those who are experiencing heavy losses. It is within this group that the heavy mortality is found. The in and out movement is taking place all the time, and it is not the same group of men who are losing year after year.

COST OF CREDIT

The association is the main source of cash credit for the berry farmer. This credit costs farmers a flat rate of 10.47 per cent, or a term rate of 15.69 per cent. At this apparent high rate, the associations are making very little on the interest account, since some of them pay more than 16 per cent for the use of the money which the membership uses.

Some farmers will look upon these figures and realize that they are considerably below what they actually paid. Others will look upon them with great surprise, and feel that they are exaggerated. However, this average is based upon data of which there is no reason to doubt the authenticity. Merchant credits were even higher for the year 1928. It cost the farmer in the berry area on an average of 18 per cent to open an account at a store, more than it would have cost had he used cash.

Crates carry a margin from one cent each to 10 per cent of the value. These margins are lower than the farmers think they are. Competition between these associations forces them, in centers where there are several associations to reduce the margins to a minimum. If one association supplies fertilizer and boxes for a lower price than its competitor, this gives an opportunity for it to bid for membership the coming year. Even with apparent low margin on fertilizer and crates, great advantages could be had in collective buying, so long as cash could be had to pay for goods upon delivery.

TABLE IV

Frequency Distribution of Charges Made by Local Associations for Handling Fertilizer and Crates, 1929-30 Season, Louisiana Strawberry Area

FERTILIZER		CRATES	
Margins charged per ton	No. Ass'ns	Margins charged per crate	No. Ass'rs
Less than $1.00	3	Less than 1 cent	1
1.00 to 1.50	6	1.0 to 1.5	10
1.50 to 2.00	0	1.5 to 2.0	1
2.00 to 2.50	2	2.0 to 2.5	1
2.50 to 3.00	2	2.5 to 3.0	7
3.00 to 3.50	1	3.0 to 3.5	6
3.50 to 4.00	8	3.5 to 4.0	0
4.00 to 4.50	4	4.0 and over	2
4.50 and over	2		
Total	28	Total	28

It will be noted that three associations charged less than a dollar per ton to handle fertilizer. Only two organizations charged more than $4.50 per ton. The remainder ranged between these two extremes. These figures are based on the list price. Those organizations that paid cash for the fertilizer used, received a 10 per cent discount, which made it possible to make an additional $3.00 or $4.00 per ton.

The above distribution shows that crates were handled on very close margins. Only one association handled crates for less than 1 cent, while ten associations handled this business for 1 cent to 1.5 cent per crate. Only two associations charged as much as four cents per crate, or more. Here again cash business made it possible to enjoy a 10 per cent discount on the list price. The average list price last year was approximately twenty-eight cents.

Cooperative effort on the part of the berry farmers could possibly get closer prices than were paid by the associations last year. When the buying power is placed in the hands of a central agency for such large quantities of fertilizer and crates as are used by the berry growers, manufacturers will strive to get the business and will sell on very close prices.

One of the big savings that can be made by berry farmers is in the purchase of unmixed goods that go to make up the complete fertilizer, and mix them on the farms.

Last season local associations had the different complete fertilizers and the unmixed goods quoted as is indicated in the following table. These prices were quoted for Hammond as an unloading point.

TABLE V

Comparison of Prices of Ready Mixed Fertilizers and Home Mixed Fertilizers on Basis of Equivalent Plant Food

Analysis N. P. K.	Ready Mixed, Prices per Ton*	Home Mixed, Prices per Equivalent
3—10—3	$33.05	$23.00
4—12—4	39.45	29.06
3—10—5	35.05	24.66
4—10—2	35.80	24.99
5—10—5	40.50	30.30
4—10—7	40.75	29.14
6—10—7	48.15	34.77
6—12—6	48.50	36.35
5—15—5	46.70	36.33

Ingredients in which materials can be purchased.

Acid Phosphate, 16%	$ 19.70	Nitrate of Soda, 15%	$ 45.97
Acid Phosphate, 18%	21.95	Nitrate of Soda, 16¼%	45.82
Acid Phosphate, 20%	24.15	Sulphate of Am., 20.5%	50.00

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*There was a 10 per cent discount allowed for cash on all mixed goods and phosphate. The above prices on mixed goods and ingredients are taken from a price list sent out by the Louisiana Farm Bureau, 1929-30 season.

If cash is not used, it is clearly seen that farmers are paying from $10.00 to $12.00 per ton for having the manufacturers mix the fertilizer and for freight and other handling charges on inert materials.

TABLE VI

Price per pound for available plant food according to source

Available Plant Food, Sources	Price per Pound in Dollars
16 per cent acid phosphate	.0617
18 per cent acid phosphate	.0609
20 per cent acid phosphate	.0603
15 per cent Chilian nitrate of soda	.1532
16¼ per cent Arcadian nitrate	.1409
20.5 per cent sulphate of ammonia	.1219
15 per cent calcium nitrate	.1454
50 per cent murate of potash	.0415
30 per cent manure salts	.0446
20 per cent manure salts	.0508
14 per cent manure salts	.0622
12 per cent manure salts	.0705

There is quite a variation between price per pound for available plant food as different sources are considered. The apparent high priced goods give the lowest cost per pound of plant food. For example, the 50 per cent murate of potash was quoted last year for $41.57 per ton. This is equivalent to 4.15 cents per pound for available potash, and 12 per cent manure salts was quoted at $16.92 per ton which is equivalent to 7.05 cents per pound for available potash. The difference between 7.05 cents and 4.15 cents is 2.90 cents. A significant figure when considerable quantities are used. Nitrogen and phosphate are also cheaper per pound when the higher test materials are considered. The values of home mixed fertilizer, as indicated in Table V, are based on the use of 20 per cent acid phosphate, 50 per cent murate of potash, and 16¼ per cent Arcadian nitrate. Should a farmer wish to use the equivalent of a 4 - 12 - 4 fertilizer, he can get this analysis by mixing 1,200 pounds, 20 per cent acid phosphate; 492 pounds Arcadian nitrate, 16¼ per cent; and 160 pounds murate of potash. This will equal 1852 pounds of fertilizer which contains the same available plant food that a ton of 4 - 12 - 4 ready mixed fertilizer contains. The difference in price is $10.49. Part of this difference goes to freight on 148 pounds filler, and the other is a charge made by the fertilizer company for mixing. Most farmers can afford to sell their labors for the price charged by the manufactures for mixing fertilizer.

If a farmer is accustomed to using 800 pounds of 4 - 12 - 4 mixed fertilizer per acre, 750 pounds of home mixed goods will be equivalent. A saving of $10.00 per ton on mixing, $3.50 per ton on collective buying, and a ten per cent discount that can be had in many cases through cooperative financing methods, would amount to approximately $15.00 per ton on all mixed fertilizers now used.

FINANCING LOCAL ASSOCIATIONS

With few exceptions, local associations depend on specialized financing agencies for credits.

In the past, local banks have been able to take care of these needs. More recently banks have found it hard to meet the needs of the local associations, due to the increased demands for funds. Also the available loan fund is shrinking relative to needs. These conditions have led to the formation of agricultural credit corporations, through which some local associations obtain money from the Intermediate Credit Bank of New Orleans. Some associations are being financed by local banks, others are using money from members of the organization, others are not operating due to unfavorable conditions in securing credits.

CENTRAL SELLING AGENCIES

There are two auctions in Hammond, and a selling exchange located at Baton Rouge. These handle practically all the berries from the area.

The Miller Auction at Hammond handled approximately 55 per cent, the Strawberry-Vegetable Auction also at Hammond handled 43 per cent, and the Louisiana Farm Bureau Selling Exchange, located at Baton Rouge handled approximately two per cent of the strawberry crop during the 1930 season.

The Miller Auction is purely a private organization, and operates for profits. The Strawberry-Vegetable Auction is cooperative insofar as the local associations are concerned, but is not cooperative from the standpoint of the farmers. The associations that go to make up this auction are both private and cooperative. Each association is represented on the board of directors by one man from each of the member associations. The private organizations have equal voice in the management with the cooperative associations. If there are any benefits to be derived, the farmers get them where they are members of cooperatives, while those who work with private associations pay the price for the service, and never expect a rebate, regardless of profits made. The association managers of these private organizations assume all losses or gains. The Farm Bureau Selling Exchange is made up of local associations that are cooperative, and work for mutual benefit. The central is incorporated without capital stock, while the locals are unincorporated. The locals are merely loading associations.

The two auctions in Hammond render several services, some of which involve hazards for the auction company. The primary function is to sell berries, and collect the sales price before title to berries is transferred. In addition to this service, these auctions pay for inspection service, look after car service, damage claims, pay for local express, and route cars to their proper destination. The managers of these auctions are in close touch with market conditions and keep Hammond prices in line with central market prices. If buyers are inactive on the auction, berries are bid in by the managers and resold by wire, or to cash buyers after the auction. It often happens that the managers misjudge what the price should be, and a loss is experienced by the auction, by paying the auction price and selling for less on the central market. The auctions absorb these losses. They also take care of any losses due to shortage in load, leaky berries and other claims with which they are confronted. Apparently these losses could be placed on the group responsible for them to an advantage. By placing the responsibility of shortage in loading, poor quality pack and the like on local associations, more careful work in checking the load and handling the product would result. As it is, these losses are paid for by all associations, regardless of where the fault is, and the careful organizations are penalized for the acts of those belonging to the same central selling organization, by paying a relatively higher price for the service than is necessary to cover the expenses for those particular units.

There is quite a misapprehension on the part of farmers and leaders in the berry area as to the profits made in the auction business. A number of services are rendered of which the outsider is not aware. All these services cost money, and the auction pays the bills.

Among the expense items are found: Salaries for office help, inspection fees, brokerage, local express charges, lights and water, traveling expenses, telephone, and telegraph, advertising, stationery, donations, entertaining, attorney fees, and many miscellaneous items.

TABLE VII

Distribution of Receipt by Hammond Auction Companies for the Season 1929-30

Expense Items	Per cent of Total Income
Salaries	22.40
Inspection	13.70
Telephone and telegraph	6.70
Brokerage	4.30
Local Express	4.40
Advertising	2.80
Traveling expenses	1.90
Stationery	1.50
Entertainment	1.00
Donations	.53
Attorney fees	.21
Fuel, lights, water, ice, etc.	.27
Miscellaneous	17.10
Loss on purchase and sales	11.26
Profit margins	11.93
Total	100.00

The total income for the two auctions equaled 2.64 per cent of the value of their total sales. Total expenses, as reported, equaled 2.33 per cent of total sales, leaving an operating profit of .31 per cent of value of total volume of business handled for the 1929-30 season.

When the two businesses are combined, we see that the difference in income and out-go is not enough to permit very great profits to accrue.

There is some duplication of effort in the two organizations that might be eliminated through consolidation. In the first place, salaries could be reduced considerably, but not necessarily fifty per cent, inspection would remain the same, telephone and telegraph could possibly be reduced, local express could be partially eliminated, since there would be no reason not to load a car if sufficient berries were brought to the loading point, advertising could be better systematized and possibly made more effective. Traveling expenses could be reduced by nearly fifty per cent, as well as fuel, lights, water, and fixed expenses on equipment.

Consolidation of the two auctions could reduce the actual expenses of operation by about twenty-four per cent of the present cost. This is a conservative estimate of economies that could be accomplished. Further economies could be realized for the industry by centralizing all accounting in the central selling organization, and reducing the clerical force in the local association to a minimum. An average of $4,911 per local association is out of proportion to the services rendered. One of the important items of expense is salary. Accounting work is responsible for most of the salary. The installation of proper machines at the central office, with an efficient accountant over trained operators, could do the work for the entire area at a minimum cost. Each local could maintain its office, and keep a paid clerk to take care of local work under the supervision of the central office.

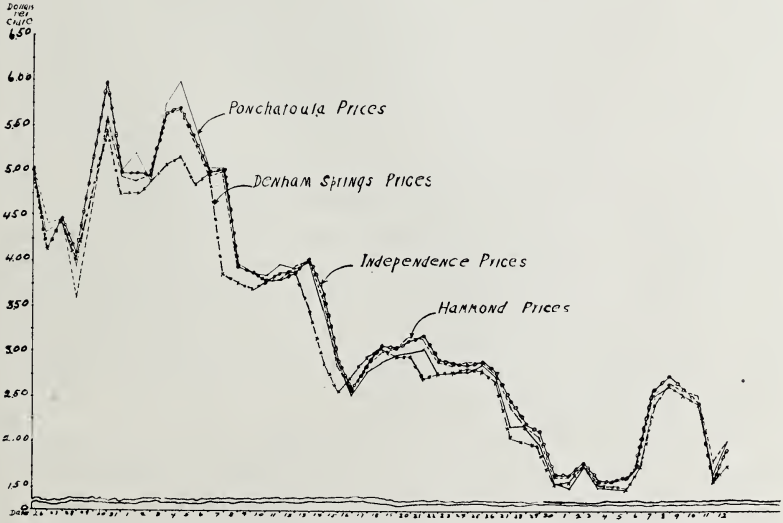

Figure 4: Prices paid on Hammond auction for berries loaded at four different shipping points—from March 26th to May 12th, 1930.

VARIATIONS IN PRICE FOR DIFFERENT SHIPPING POINTS

If the associations are distributed on the basis of average price received during 1930 season, the distribution will be as indicated in the following table:

TABLE VIII

Frequency Distribution of Average Prices Received by the Different Associations for the Season 1930

Price	Number of Associations
Less than $2.20 per crate	2
$2.20 to $2.30	2
2.30 to 2.40	0
2.40 to 2.50	3
2.50 to 2.60	5
2.60 to 2.70	13
2.70 and over	3

The range in price is $2.11 to $2.88, with an average as reported by the associations of $2.61 per twenty-four pint crate. Two very small associations received relatively low prices, the extra large associations did not receive the extra high prices. The low prices were received by growers in the north end of the berry area, while the highest average was reported by one of the associations in Independence. These associations do not consistently hold the lead year after year. During the 1928 season, the highest average was received by one of the associations at Albany, $3.28; and one of the Hammond associations received the lowest average, 2.39, a difference of $.89. The average for all the associations reporting was $3.12. In 1929, Independence again received the high average at $2.60 and Hammond the low at $2.00, or a difference of $.60. Average for all reporting was $2.39.

There are several reasons for this variation in prices from point to point. One of the main factors is no doubt the proportion of berries an association gets on the market while prices are high, and the alertness of the association to quit picking when prices drop below a profitable level. Some associations, due to their methods of operation can afford to pick and ship longer than others. Efficient service at low cost give some returns when berries sell for relatively low prices. On the other hand, there are some associations that run consistently high as compared to the prices at other points. The Albany people, while they do not necessarily average the highest price every season, are near the top. In this case, pride in putting up high quality packs has caused the buyers to seek Albany berries, and often they pay a premium for them. Weather conditions at the different local points cause variations. Hard rains are experienced in some communities, while ideal weather conditions prevail only forty or fifty miles away. The lack of a sufficient labor supply to pick over the field before the sun begins to damage the ripe fruit, and often the temptation to continue to pick and pack in the afternoon and ship out the next day is great. This practice causes inferior berries to be placed in the car, thus causing a reduction in price offered for these cars. At some points in the area, people do not work on Sunday. The two days picking on Monday often results in low quality fruit. This is especially true later in the season when the fruit ripens rapidly. The one strong factor controlling price paid for berries is the ability of buyers to reach the different local points during the loading hours. The outlying points are not visited by the buyers and they are reluctant to bid on the berries of which they know nothing. Federal inspection, together with good highways, will remove this difficulty to a large extent.

The associations that fall on the lower half of the range should examine themselves and find out why their prices are consistently low. If due to careless handling, or improper cultural methods, or anything else that is due to human causes, a correction of these defects would increase the chances for better returns.

When the average daily auction prices for berries from the different points are plotted, there is a tendency for these prices to vary little from point to point. Fig. 4 shows how close together these prices are, from day to day, for Ponchatoula, Hammond, Independence, Amite, and Denham Springs. It is to be noted that there was a difference in average price of Hammond and Independence berries of fifty cents per crate on March 29th. Denham Springs and Independence berries sold for differences of fifty cents per crate on March 31st. On April 6th, the prices came very close together and remained so to nearly the end of the season. The season's average for the five points are reasonably close together, but there is sufficient variation to justify a checking up on methods and practices by those associations that are below the average.

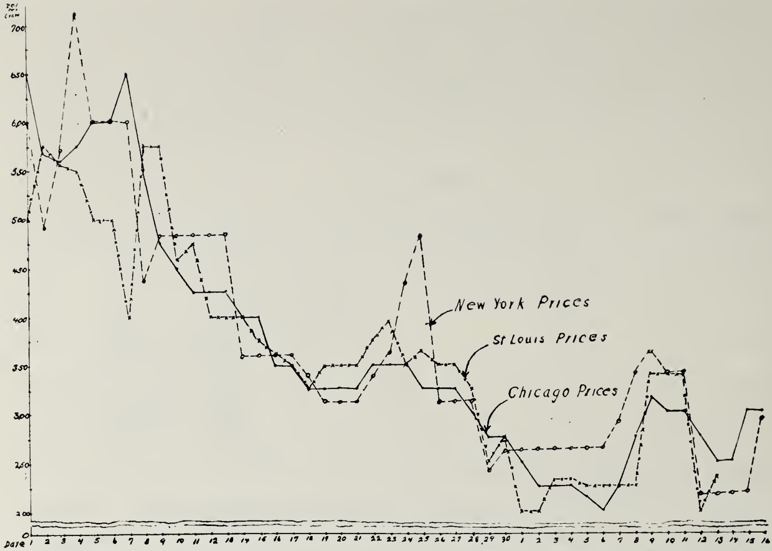

Figure 5: Comparison of L. C. L. prices to jobbers of Louisiana strawberries in three central markets from April 1st to May 15th, 1930.

PRICES IN CENTRAL MARKETS

Berries from the Hammond area are received in car lots by 134 markets throughout the United States and Canada. One of the tests of the efficiency of the marketing machinery in the berry area is the spread in price on the same day at the different markets. The Market News Service of the Bureau of Agricultural Economics releases daily sheets reporting carlot receipts and jobber prices at the different important markets. When express and icing charges are taken into account, there is a rather uniform price for Louisiana berries throughout the country. Minneapolis, Minnesota is one exception, following the prices day by day throughout the season, there appears to be some artificial force that limits shipments to this center, and thereby holding prices out of line with those in other centers.

Prevailing jobbers prices for New York, Chicago, and St. Louis for forty-five days are compared in Fig. 5*. The differences between prices in different markets on the same day are brought out in these three typical markets. It will be noted that rather wide differences appear in the early part of the season. Extreme variations appear on April 7th, when St. Louis was paying $4.00 per twenty-four pint crate, and Chicago was paying $6.50. It will be further noted that the marketing agencies in the berry area reacted immediately and loaded Chicago to the extent that prices dropped the following day, while St. Louis cleared out and prices moved upward.

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*Daily releases, Market News Service, Bureau of Agricultural Economics, Spring, 1930.

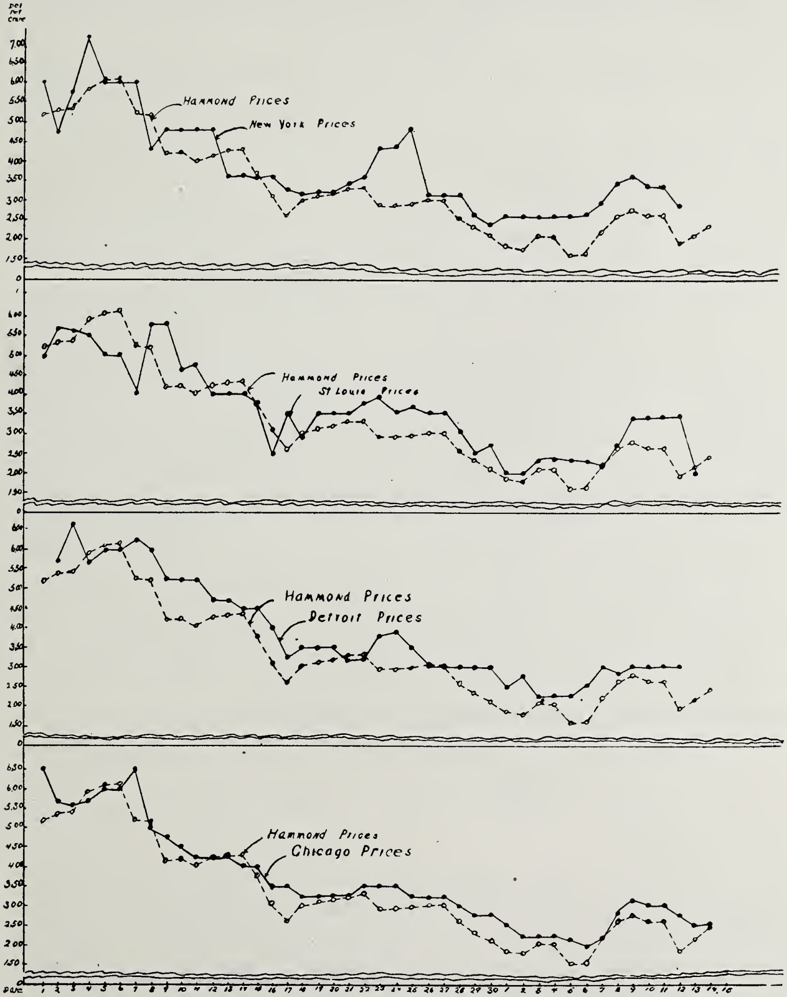

Figure 6: Strawberry prices on Hammond auction compared with L. C. L. prices to jobbers in four central markets from April 1st to May 15th, 1930.

After the first few weeks of shipping, there is a tendency for the prices to even up. However, the movement of fruit to the different points is not timed exactly, but indications are that a close contact is maintained with the markets. There is also an indication that relatively higher prices in certain markets attract too many berries, and depress the price unduly.

DIFFERENCES BETWEEN AUCTION PRICES AND CENTRAL MARKET PRICES

Many farmers in the berry area, as well as some association leaders, criticize the auction method of selling berries, by assuming that buyers get together before the auction takes place and fix the price of berries. In answer to this question, Fig. 6 is presented. In each of the central markets, high, low and prevailing prices are quoted for sound salable stock. There is also a high and low price quotation at the auction, as well as an average daily price. In comparing prices at the auction and at the central markets, the question arises; What prices should be used for this comparison? Buyers are influenced in the price they pay at the auction by what the market is paying on that day, and what he thinks it will pay by the time his purchases arrive on the market. Low quotations on the central market evidently control the maximum price paid on the auction, when dealers opinion is eliminated. However, for the purposes of illustration, and presenting an approximate picture of conditions for the 1930 sales, average auction prices have been plotted against low quotations to jobbers for number 1 berries at Chicago, New York, St. Louis, and Detroit. These plots are based on activities from April 1st to May 15th. The simple average of jobber prices paid in the Chicago, New York, St. Louis, and Detroit markets are \$3.68, \$3.84, \$3.67, and \$3.93 respectively.

The prices on the Hammond Auction during the same period, simple average, was \$2.55 per twenty-four pint crates. This leaves a margin of \$1.13, \$1.29, \$1.12, and \$1.37 respectively for the four markets.

Charges for icing and express on each car to Chicago are \$341.04, to New York, \$478.87, St. Louis, \$341.04, and Detroit, \$427.87. Using the average number of crates per car for the past season, 720, the express and icing charges per crate were \$.47, \$.67, \$.47, and \$.59 respectively for the above cities. The central receiver or buyer receives a commission of 10 per cent. This amounts to approximately $.25 per crate. This leaves for the legitimate buyer $.41, $.37, $.40, and $.53 in the cities as heretofore named. Out of this a charge of $9.00 per car must be paid for bracing. The remainder is the price that is paid to middle men for assuming the risk of falling prices before the berries arrive on the central market, and deterioration in quality while in transit.

The amount of risk involved is indicated by Fig. 6. Close observation will reveal that there are many days when a higher price is paid on the auction than is quoted on the central market by the time the berries arrive.

Specific cases are cited. Berries bought in Hammond on April 5th for an average of $5.55 per crate were quoted in St. Louis the second day following for $4.00 per crate. Buyers in other markets experienced similar situations. This results in loss to those firms that buy F. O. B. Hammond. There are sufficient upswings in price in the central markets to offset these losses, as can be noted from the chart.

Considering the price movements both in Hammond and in the central markets, the upward and downward swings are too near together to conclude that buyers are in any degree controlling the price of berries on the Hammond Auction. We are forced to resort to our time-worn theory of supply and demand, to explain these price variations.

RELATIONSHIP OF PRICE TO TYPE OF CAR USED

Another contention that prevails in the area is that buyers discriminate against berries that are loaded in short cars. This contention is not without some basis. However, this relationship is not great enough to cause strife between loading organizations in securing certain series of cars. I. C. car series 4300, 4400, 4500, 4700, and 4800, are short cars, and shippers believe that buyers discriminate against berries loaded in these cars. These cars were combined and daily average prices were determined for berries loaded out in these from April 1st to May 16th. The same thing was done for the large cars. These two price series are plotted in Fig. 7. During the forty-five days considered there were twenty-eight days on which the large cars sold for a higher price. This difference ranged from one cent to 33 cents per crate. On eight days, the short cars averaged the higher price, ranging from one cent to eight cents per crate, and the remainder of the time there appeared no difference in the average price. If we were to assume that buyers would have paid the same price for all the berries as were paid for those in the large cars, the returns would have been $21,086.82 more than they were. There were only four days during the forty-five that more than 10,000 crates were loaded in the short cars. On April 12th, 16,637 crates were placed in short cars and sold for an average of 21 cents less than those loaded in large cars. April 14th, 15,737 crates were thus loaded and sold for 33 cents per crate less. April 23rd, 13,041 crates were loaded in short cars and sold for 28 cents per crate less. But, on April 29th, 14,880 crates were loaded on short cars and the average price just equaled the price for berries loaded on long cars. Apparently, the discrimination is greater in the earlier part of the season than toward the latter part.

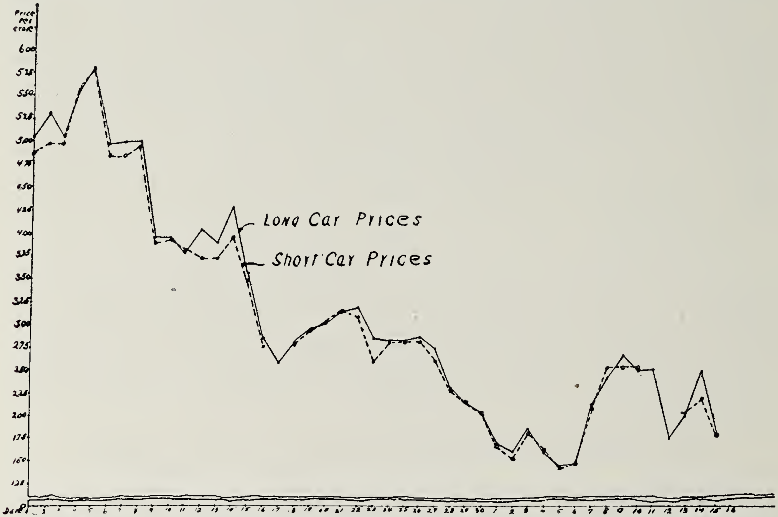

Figure 7: Comparison of prices paid on the Hammond auction for berries loaded on short and long refrigerator cars from April 1st to May 15th, 1930.

There are two reasons why buyers seek the larger cars to the degree indicated. First, there is a tendency for berries to be loaded five high in the short cars in order to approach the minimum tonnage allowed by the express company, which is 17,000 pounds. Berries loaded over four crates high are likely to deteriorate in transit, especially the fifth layer, due to improper refrigeration at this height. Second, the buyer is charged a fixed rate for icing and express, regardless of type of car or load. It requires 850 twenty-four pint crates of berries of twenty pounds each to give a minimum load. These short cars cannot carry over 684 crates, loaded four deep and nine wide, with safety. This means that express and icing charges are made on 3,320 pounds not represented by strawberries. It is readily understood why the large car loaded to approximately the minimum tonnage will sell for more per crate, if other things are equal.

There are other factors that enter into these price differences. Prices vary on the same day from shipping point to shipping point, for reasons already stated. Should one of the low price points load several short cars on those days when there is a wide difference in price, there would be a double force operating to put the price lower for berries loaded in short cars than for those loaded in long cars.

Apparently these short cars were distributed to the different loading points according to the law of chance. Of the total number of cars loaded in the area, twenty-three per cent were short cars. The percentage of short cars of total cars loaded at the following points was: Amite, twenty-four per cent; Independence, twenty-nine per cent; Hammond, twenty-nine per cent; Ponchatoula, fifteen per cent, and Denham Springs, nineteen per cent. When the entire season and all loading points are considered, the average car lacked 2,600 pounds carrying the minimum load allowed by the express company. This resulted in the use of approximately fifteen per cent more cars than was necessary had minimum capacity cars been supplied.

DEFECTS IN HANDLING BERRIES THROUGH MARKETING CHANNELS

Losses experienced in the marketing process can be traced primarily to the following causes: First, poorly equipped express cars that fail to furnish proper refrigeration for berries while in transit; second, the improper loading of cars, that is, placing too many packages in one car thereby interfering with proper movement of air currents, thus causing damage to the top tier of packages. When berries are stacked over four packages deep there is danger of deterioration. Careless manufacturing of crates, leaving the ends of boxes uneven, with projections of the sides over the end, make it easy to load the crates to where the slightest side movement will cause end play between packages, and result in so-called shifting of loads. This shifting causes leaky berries, and consequently claims come back on the auction or express company; third, refrigerator cars are cooled before they are spotted on the siding to be loaded. Loaders are prone to leave the car doors open at times when it is unnecessary. At times both sides of the car are opened and left open for hours. This permits the temperature inside the car to rise, and when warm berries are loaded in the car and it is finally closed, several hours are required for cooling to take place, and in some instances much extra icing is necessary. As a result of slow cooling, berries often damage before they reach the central markets. Fourth, there are some instances where cars are not moved rapidly enough due to delay on part of salesmen. This causes delay in transit and loss is experienced through over ripe condition of berries when they arrive on the market. Fifth, there is a tendency on the part of some people in the berry area to impair the effectiveness of inspection service. There is sufficient evidence to indicate that inspectors turn down packages of berries as unclassified and persons in charge of loading relabel these packages and slip them into a car as number 1's. This practice though not common, has a damaging effect and is likely to cause buyers to become skeptical when buying berries from this point, and lower prices will be the result. Sixth, berries that do not come up to standard are marked unclassified by the inspector. These berries are sent to the same market that receive the number 1 berries. The consumer in the central market is not aware in most cases, that his dealer is handling second class fruit. One purchase of poor quality fruit by a consumer is likely to result in loss of a customer even though there is a price differential to take care of the difference in quality. The loss of customers, and the depressing of price, is sufficiently grave to make it prohibitory to place second class berries on the same market with number 1 berries. This is especially true after the season is well under way. At the first of the season when berries are scarce there seems to be no direct disadvantage in sending unclassified berries to the market. This could be carefully watched by the marketing agencies and when conditions are such that unclassified berries depress the market, the withholding of this class of fruit would be advantageous. Seventh, too many labels or brands are used at the different shipping points by the various associations. This often results in mixed loadings, which in turn is reflected in price. There were times last season when cars were sold at auction as loaded with a given brand of berries and when the car arrived in the central market, other brands would be found. Loaders failed to inform the Auction that a few crates of another brand had to be used to finish loading the cars. The buyer would then present a claim to the Auction, and justly so, for not getting what he paid for. Apparently the first condition mentioned is the most important. A brief analysis will give its due importance. A check on an adequate sample of last season's business indicates that eight per cent of all cars shipped out of the Hammond territory damaged while in transit and claims amounting to 1.2 per cent of the sales value were paid by the Central Selling agencies because of spoilage of fruit before it reached its destination.

Leaders in the Hammond territory believe that the type of car has much to do with these losses. Of all the cars on which claims were made, fifty per cent were the short ill equipped type. Seventy-two per cent of this class were I. C. cars, of the series 4300, 4400, 4500, and 4700. The remainder were R. E. X. cars, 400 series, and a few A. R. E. cars. The losses experienced on the above cars amounted to sixty-four per cent of the total losses, however these cars represented only fifty per cent of the total cars having losses. As has already been indicated there are causes for losses other than the type of car. This is substantiated by the fact that fifty per cent of the number of claims were made on berries shipped in large well equipped cars. There is little doubt but what there is some relationship between the type of car and losses incurred if other factors are eliminated. These poorly equipped antiquated refrigerator cars should be converted into freight cars and replaced in the express service by large well equipped up to date cars. This recommendation is justified on the basis that have been suggested already, first, small cars cannot be loaded to get the advantage of minimum tonnage allowed by the express company, consequently express is paid on dead space; second, the apparent discrimination by buyers causes losses to growers which amount to twenty or twenty-five thousand dollars annually; and third, the apparent losses due to poor conditions of these small cars.

Apparently there is a mutual benefit to be derived for both railroad company and berry growers from making available suitable cars, reducing the minimum tonnage to be consistent with the load that can be placed in the car and possible adjusting the express rate to the point of more equitable distribution of the sales receipts. Last season the express and icing charges per car regardless of type of load, to the following points were: New York, $478.87; Cleveland, $415.97; Toronto, Canada, $617.50; Chicago, $341.04; Detroit, $427.87; and other points throughout the country in about the same amounts. Of this charge $55.00 to $80.00 was an icing charge.

The railroad company is interested in the expansion of the berry and truck industry. To encourage this expansion it is necessary to narrow the gap between the Hammond prices and the central market prices to a minimum. This will stimulate consumption in the central market due to lower prices, and the producer will expand his business to where the cost will absorb the small share that comes back to the farmers. This will result in more cars of produce to be hauled, and until the adjustment is made on the farm it will mean a greater net income to the producer.

CONCLUSIONS

The foregoing discussion has pointed out some of the defects that persist in the berry industry. It has attempted also to use facts to show that certain fallacies exist in the minds of people in the area. In this concluding section an attempt is made to present certain conclusions and recommendations that must be considered if certain of these defects are to be eliminated.

1. There are too many local associations in the berry area, and these are costing the farmers out of proportion to the services rendered.

2. Farmers are paying prices for marketing service, mercantile service and credit service out of line with the income and services they receive.

3. Many dollars can be saved through efficient cooperative action in securing credits and purchasing major farm supplies, as fertilizer, crates and feed for cash.

4. The present system of handling the berry crop is not conducive to large gains for any of the agencies involved. A change in this method will not effect adversely the profits of those engaged in handling the crop, but a change for the better, after adjustments are made will be beneficial to merchants, bankers, and all who depend on the berry industry for an existence.

5. There is sufficient evidence to show that the type of car in which berries are loaded reflects itself in the prices paid. These inferior cars should be relegated to the trash heap, or placed in freight service where more durable commodities are hauled.

6. There are no substantiating facts that will lead to the conclusion that buyers voluntarily control the price of berries on the Hammond Auction.

7. There is not that high correlation as some suspect, between the type of car and the claims that come back on the Auction. However, there appears to be some relationship. Further study on this particular point is necessary before definite conclusions can be reached.

RECOMMENDATIONS

1. A consolidation of all existing associations at each of the shipping points, or a complete reorganization, with one strong local cooperative association at each of the main shipping points is desirable. At those points near each other where insufficient berries are produced to load in car lots consistently, one association could serve two or more of these points. One label or trade mark to be adopted for each shipping point, to keep down mixed loading. To keep down duplication of effort and reduce expenses of operation to a minimum, but maintaining the maximum efficiency is of prime importance in any industry.

2. To organize a central selling organization cooperative in nature and made up of local cooperative associations.

3. To locate this central organization in Hammond, and equip its offices with modern bookkeeping machinery, where the accounting for the entire organization, including locals, can be centralized and efficiently done.

4. A sales manager be employed and placed in charge of the central organization. This manager to have had successful experience in the berry business and should be the best that money can buy.

5. The central organization to maintain a Credit Corporation, capitalized at such a rate that a line of credit of $3,000,000 can be obtained if found necessary.

6. This credit corporation to be managed by a hired manager to be selected on the basis of business ability and banking experience.

7. The central organization to maintain a purchasing department, through which all crates, hampers, fertilizer and feed can be obtained. This department will make it possible to utilize hired management and clerical forces more efficiently.

8. Every transaction to be put on a cash basis this to be made possible through the proper functioning of the Credit Corporation.

To carry out the above recommendations, it is suggested that berry producers organize themselves according to the plan submitted in the appendix of this publication. Outside financial aid will be necessary to carry out the proposed program. The Federal Farm Boards stands ready to assist Louisiana berry producers when and only when they demonstrate their willingness to help themselves.

APPENDIX

PROPOSED PLAN FOR A CENTRAL AGENCY FOR MARKETING LOUISIANA STRAWBERRIES*

It is believed that improvement in the situation of Louisiana strawberry growers must be founded on a thorough organization of farmers for marketing purposes.

It is therefore suggested:

1. That a more complete organization of the strawberry growers of Louisiana will constitute a most effective instrument whereby these producers may sell their crops and through which the Federal Farm Board may work with the industry.

2. That the nineteen local cooperatives now in existence in Louisiana handle about 49 per cent of the Louisiana production of strawberries.

3. That very definite good has been brought about through the operation of these cooperative units.

4. That some of their greatest values have thus far been to improve grading practices and influence competitive practices at country markets.

5. That some cooperatives, because of smallness of size or for other reasons, have not been able to develop proper credit and marketing arrangements for their members.

6. That, while these cooperatives have rendered real service to members in many ways, it is necessary that present and future cooperatives shall increase the volume of products controlled in order to reduce the costs of operation, increase effectiveness in merchandising, bring about a more equitable distribution of supply, influence the adjustment of supply to demand, secure greater economies in the purchase of supplies, and establish full bargaining power for strawberry growers in the selling of their products.

7. That a large proportion of the strawberries produced in Louisiana is produced under some form of crop lien or some other form of legally acknowledged obligation, that these obligations often directly prevent growers in their efforts to join cooperatives and to market their products cooperatively, and that cooperatives

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*This proposed plan was discussed with leaders in the Louisiana strawberry industry and with representatives of strawberry associations at mass meetings held in Hammond in August, 1930.

The plan was developed by members of the staff of the Division of Cooperative Marketing of the Federal Farm Board and the Louisiana College of Agriculture and is believed to be in accord with the policies and program of the Federal Farm Board.

cannot obtain materially greater volume unless the control of production credit is friendly to cooperative marketing by growers.

8. That this greater volume cannot be obtained unless growers themselves have faith in the ability of the cooperative associations to give them definite benefits, either by way of price or other important commercial service, which they cannot get by remaining outside of cooperative associations.

9. That in order to get the desired volume of business, efficiency of operation, reasonably low costs to the membership, real effectiveness in merchandising, and a medium whereby the Federal Farm Board may work with Louisiana growers under the provisions of the Agricultural Marketing Act, some changes need to be made in the present cooperative marketing structure, to the end that all associations may be able to render efficient service to their members and become more centralized in their merchandising operations than they are now.

In view of the foregoing the following suggestions are made:

1. There shall be established a central marketing organization for strawberries. This organization shall be a non-profit cooperative association either with or without capital stock operating so that contributions to capital shall be proportional to the patronage of its member associations. Only such capital requirements shall be paid in as is necessary in the opinion of the directors from time to time. Contributions to capital shall be payable in cash as determined by the board of directors. Membership shall not be transferable without the consent of the central association.

(a) The charter and by-laws shall comply in all respects with the Act of Congress approved February 18, 1922, entitled "An Act to authorize associations of producers of agricultural products", otherwise known as the Capper-Volstead Act.

2. The members of the central associations shall be local cooperative organizations complying with the provisions of the Capper-Volstead Act, handling strawberries and processed or manufactured products derived from these commodities. Local associations shall meet the following conditions:

(a) Growers in any locality in Louisiana when organized and incorporated under the Louisiana State laws and which meet the Capper-Volstead requirements, shall constitute an association which may become eligible to membership in the central agency upon the approval of the Board of Directors.

(b) Each local association may become a member of the central agency by executing the marketing agreement and subscribing to the capital thereof at the rate of ¼ cent for each crate of strawberries received by it from its members, based on its average annual carloadings for a period of three years preceding the date of its application for membership. In case of an association, less than three years old, the Board of Directors of the central agency shall determine the amount of the capital subscription on an equitable basis.

(c) Member associations shall have sufficient tonnage to ship in carload quantities.

(d) Member associations shall require all their members to execute a growers marketing agreement acceptable to the Board of Directors of the central agency. This contract shall meet with the approval of the Federal Farm Board.

(e) Each member association shall agree to standardize grades and to pack their products according to Louisiana State standards and U. S. Standards in accordance with regulations prescribed by the Board of Directors of the central agency.

(f) Each member association shall contract to market all the products of the association through the central agency, as hereinafter provided.

(g) Each member association shall pay a prorated, per package, charge to the central agency equal to the expense of operation, such operating expense to include amounts for the establishment and maintenance of such reserve funds as may be agreed upon by the Board of Directors of the central agency.

(h) Each member association shall agree to furnish to the central agency promptly on call or as set forth in the agreement any and all information relative to production, crop conditions, or other data required by the central agency in furthering the purposes for which it was formed.

(i) Each member association shall execute a contract with the central agency in which it is agreed that the association will market all its products through the central agency and which permits the central agency to pledge the products delivered to it by the member association as collateral for funds borrowed by the central agency. This contract shall meet the approval of the Federal Farm Board.

(j) Each member association of the central agency shall be entitled to elect one director to the Board of Directors thereof.

(k) Each member of the Board of Directors of the central agency shall have one vote.

(l) An Executive Committee of five members shall be elected from the members of the Board of Directors.

3. The purposes of the central agency shall be:

(a) To provide central marketing facilities and sales services for all member associations. In the discretion of the Board of Directors of the central agency, strawberries may be sold (1) directly by it or (2) by a sales organization with which the central agency may contract.

The sales policy is to be directed toward the coordination of cooperative effort in the sale of the products of the member associations.

The policy of the central agency shall be such as to continue as far as possible the present policies and management of local organizations.

(b) In the operation of the central agency its Board of Directors shall have full power of action in all matters pertaining to the operation and management of the organization including policies, finance, contracts, standardization of grades, packing methods, legal matters, claims, advertising, and shall have power to do any and all things consistent with cooperative laws and the Agricultural Marketing Act, necessary to insure better marketing conditions for its members.

(c) To promote the effective merchandising of all strawberries produced or controlled by farmers' cooperative organizations in Louisiana and for other organizations or individuals in accordance with the provisions of State and Federal statutes.

(d) To encourage the organization of producer-owned and producer-controlled local cooperative organizations and to strengthen those now in existence and discourage the organization of unnecessary competitive cooperatives.

(e) To effect consolidation of local associations into larger and more effective operating units, wherever such consolidations are possible and desirable.

(f) To buy, sell or act as sales agents for member associations or others as provided by cooperative laws of the State of Louisiana and of the United States, and in accordance with the policy of the Congress of the United States of America stated in the Agricultural Marketing Act, approved June 15, 1929.

(g) To borrow money for operating expenses, capital investments in Agricultural Credit Corporations, and for other purposes, to issue notes, bonds, or other evidence of indebtedness for the same, and to secure the repayment thereof by the giving of liens upon any real or personal property owned by the central agency including commodities delivered to it for sale by the member associations.

(h) To loan money to any member association as defined in the Agricultural Marketing Act.

(i) To establish and maintain grades and standards for all products handled by the central agency.

(j) To process or manufacture by-products incidental to these industries, and to own, lease or otherwise acquire the use of all such warehouses, packing houses, machinery, shipping and terminal facilities as may be necessary or convenient in so doing.

(k) To own, lease or otherwise acquire the use of any real or personal property which may be necessary or convenient in connection with the performance of any of the purposes for which the central agency is established.

(l) To maintain departments necessary for the promotion of the best interests of the members of the central agency, including production and market information, inspection, advertising, production credit, legal, traffic, accounting and sales departments; and to conduct business and statistical research activities with regard not only to the business practices of the member associations but also for the purpose of collecting, analyzing, and interpreting the factors affecting prices, production and consumption of the products sold by members through the central agency.

(m) To enter into, make and perform contracts of every kind and description with any person, partnership, cooperative association or corporation.

(n) To have one or more offices in the State of Louisiana to carry on all or any part of its operations and business in any of the states, territories and or insular possessions of the United States and in the District of Columbia.

(o) To have and to exercise all the power conferred by the State of Louisiana upon corporations formed under the laws of said State, and to do any or all of the things hereinbefore set forth to the same extent as natural persons might or could do.

4. The central agency may be recognized by the Federal Farm Board when the organization has contracts from member associations representing 60 per cent of the volume on the basis of 1930 acreage and shipments from the area.

5. The central agency shall be so organized and operated as to be eligible for loans from the Federal Farm Board and the articles and by-laws of the central agency shall be drawn in cooperation with the Board in such a manner shall furnish proper safeguards in management so long as it shall be indebted to the Federal Farm Board. The books and accounts of the corporation shall always be open to inspection by the Federal Farm Board or by any member association.

6. The central agency might organize and operate a subsidiary agricultural credit corporation with an authorized capital stock of $250,000 of which $100,000 shall be paid in. This will make possible the expansion or contraction of the subscribed capital stock to coincide with any possible operations during the next few years.

7. The central agency will see that at least 20 per cent of the capital stock of the credit corporation is subscribed by its member associations, or by growers. The payment for this stock shall be in cash in advance of the operation of the credit corporation. When this capital has been raised and the other conditions as set forth in this proposed plan shall have been met and approved by the Federal Farm Board, then the central agency will be in position to apply to the Federal Farm Board for a loan to be used to supply a part of the capital stock of the credit corporation. The total paid-in capital of the credit corporation will be invested in such bonds and or debentures as the Federal Farm Board and the Intermediate Credit Bank shall specify.

8. Three classes of stock will be provided as follows:

Class "A"
Class "B"
Class "C"

Class "A" to be issued to and held only by the central agency. This is the only stock to carry the voting privilege.

Class "B" stock to be issued to and held only by the central agency.

Class "C" stock to be issued to growers. All growers borrowers will be required to subscribe to class "C" stock a sum equal to 10 per cent of the amount of their loan. Member associations will be required to subscribe to class "C" stock a sum equal to 5 per cent of the loans approved for their members.

Both class "A" and class "B" stock will be preferred stock and may be used as collateral security for any loans advanced by the Federal Farm Board. In case there are losses which impair the capital of the credit corporation, these losses will fall first on class "C" stock, so that no losses will fall on the preferred stock until after class "C" stock shall have been eliminated. The preferred stock will be issued to and held only by the central agency.

9. The resources of the credit corporation will be made available only to grower-members of local associations which are members of the central agency, and the rules and regulations of the Federal Intermediate Credit Bank will govern the extension of loans to growers. Member associations will endorse the notes of their grower members before offering them for rediscount through the credit corporation.

10. The central agency will provide a bond as required by the Federal Intermediate Credit Bank to guarantee that receipts from sale of strawberries for which crop lien notes have been given to the credit corporation will be turned over to the credit corporation after marketing charges have been deducted.

11. Each local association will have a loan committee to pass on loans. The central agency in turn will have a loan committee selected from within its board of directors to pass on loans recommended by the local loan committees. Competent supervision will be given through field inspection by the credit corporation to see that the credits are being properly used.

12. The central agency will provide for repayment of any loan made by the Federal Farm Board to provide capital stock for the credit corporation, through the sale of stock and through the creation of a special reserve fund. The central agency shall see that one-half of the capital stock subscribed by growers and by member associations in the credit corporation shall be used annually to retire the indebtedness to the Federal Farm Board. A special

reserve fund shall be provided by the central agency levying a charge of two cents per crate on all berries handled by it. This fund, together with the income from the sale of class "C" stock, as provided above, is to repay the Board within five years for the loan advanced to provide capital for the credit corporation.

13. So long as the central agency shall remain indebted to the Federal Farm Board, its management, and policies and economic structure of the cooperative and its subsidiaries shall be such as to meet with the approval of the Board.

14. The central marketing agency may be formed in one of three ways, viz., by modification and recognition of one of the existing central marketing agencies, by merging existing central marketing agencies, or by organizing a new central marketing agency outright. If it is decided to set up a new central marketing agency, the procedure suggested is as follows:

By vote of the various cooperative marketing associations interested in this plan, through their respective boards of directors or authorized committees thereof, a committee shall be selected consisting of one member from each of the associations, qualified under the Capper-Volstead Act, that desire to participate in the establishment of the central agency. This committee shall serve as an incorporating Board of Directors, and the terms of the members thereof as such directors shall end at the first annual meeting to be held not later than (July 31, 1931).

ARTICLES OF INCORPORATION

of

....Association.

We, the undersigned, all of whom are residents and citizens of the State of.., engaged in the production of agricultural products, do hereby voluntarily associate ourselves together for the purpose of forming a cooperative marketing association, without capital stock, under the provisions of the.. ....cooperative marketing act of the State of ....

ARTICLE I

The name of the association shall be the.. ....Association.

ARTICLE II

The association is formed for the following purposes:

(a) To engage in any activity in connection with the picking, gathering, harvesting, receiving, assembling, handling, grading, standardizing, packing, processing, transporting, storing, financing, advertising, selling, marketing and/or distribution of any fruits and/or vegetables delivered by its members or any of the products manufactured therefrom and in connection with the purchase or use by and/or for its members of supplies, machinery and/or equipment.

(b) To acquire and/or handle and market the fruits and/or vegetables of its members in any capacity and on any cooperative basis that may be agreed upon.

(c) To borrow money without limitation as to amount of corporate indebtedness or liability; to pledge any of its property as security therefor in any manner permitted by law; and to make advance payments and advances to members.

(d) To act as the agent or representative of any member or members in any of the above mentioned activities.

(e) To buy, lease, hold and exercise all privileges of ownership, over such real or personal property as may be necessary or convenient for the conduct and operation of the business of the association, or incidental thereto.

(f) To draw, make, accept, endorse, guarantee, execute, and issue promissory notes, bills of exchange, drafts, warrants, certificates and all kinds of obligations and negotiable or transferable instruments for any purpose that is deemed to further the objects for which this association is formed, and to give a lien on any of its property as security therefor.

(g) To establish, secure, own and develop patents, trade-marks and copyrights.

(h) To cooperate with its members in conducting educational work concerning the value of cooperative marketing, the adjustment of production to prospective demand, and for all other purposes pertaining to cooperation.

(i) To cooperate with other similar associations in creating central, regional, or national cooperative agencies, for any of the purposes for which this association is formed, and/or to become a member of such agencies as now are or hereafter may be in existence.

(j) To have and exercise all powers, privileges and rights authorized by the laws of the state and all powers and rights incident thereto, except such as are inconsistent with the express provisions of this act.

(k) To do anything that is conducive to carrying out the policy of the Congress of the United States of America stated in the Agricultural Marketing Act, approved June 15, 1929.

ARTICLE III

The association shall have its principal place of business in the City of..County of..
State of..

ARTICLE IV

The term for which this association shall exist is..................................
from and after the date of its incorporation.

ARTICLE V

The number of directors shall consist of..,
and the term of office of each director shall be....................years, and the names and addresses of those who are to serve as incorporating directors for the first term and until their successors are elected and qualified, are:

NAME	ADDRESS
....	....
....	....
....	....
....	....
....	....
....	....

ARTICLE VI

This association shall not have any capital stock, but shall admit members into the association upon payment of an entrance fee of ....dollars, and other uniform conditions. This association shall be operated on a cooperative basis for the mutual benefit of its members as producers, and only producers of fruits and/or vegetables may be admitted to membership.

The voting power of the members of this association shall be equal, and each member shall have one vote only.

The property rights and interests of each member in the Association shall be in proportion to their patronage.

ARTICLE VII

IN TESTIMONY WHEREOF, WE have hereunto set our hands this..day of..., 193.......

....

....

....

....

....

....

State of..} SS
County of..}

Before me, a notary public, within and for said county and state, on this....................................day of.., 193......, personally appeared ....
known to me to be one of the identical persons who executed the within and foregoing instrument, and he acknowledged to me that he had executed the same as his free voluntary act and deed for the use and purposes therein set forth.

WITNESS my hand and official seal the day and year above set forth ....

Notary public in and for the county of...
state of... My commission expires
....

ORGANIZATION AGREEMENT

We, the undersigned, in order to insure the efficient production and marketing of fruit and/or vegetables grown by us; to promote, foster and encourage the marketing of fruit and/or vegetables cooperatively; to reduce speculation with reference thereto; to stabilize the markets for and the values of fruit and/or vegetables; to enable the growers of fruit and/or vegetables to obtain benefits under the Agricultural Marketing Act; and for such purposes to cooperate with the Federal Farm Board and other State and National Agencies; propose to organize a non-profit cooperative association without capital stock as hereinafter provided.

In consideration of the premises, and of our mutual undertakings, and of the agreement of each and every party hereto, we, producers of fruit and/or vegetables, hereby agree as follows, each for himself and collectively, for the express benefit of and for the association to be organized as follows:

1. We will become members of the.. Association, a non-profit association without capital stock, to be organized under the Cooperative Marketing Act of...

2. (a) The association shall be organized with suitable articles of incorporation and by-laws as determined by an organization committee consisting of the following persons. (State name and address of committee members).

(b) If any member or members of this committee shall resign or be unable to act, the remainder of the committee may elect a successor to fill any such vacancy, or may increase its membership if deemed necessary. The said organization committee may appoint an executive committee to conduct the details of its affairs. The said committee, or its executive committee, may incur necessary obligations for and on behalf of the committee and the association to be organized, make necessary expenditures and take any such action as may be deemed advisable to secure subscribers hereto.

3. The by-laws of the association shall provide among other things, that: (here enumerate the chief provisions which it is proposed shall be contained in the by-laws).

4. If, on or before..., 193......, the organization committee is of the opinion that sufficient sign-up has been obtained to enable the association to operate efficiently, the committee shall make such a recommendation to those who have signed this agreement by a notice to be published in one or more newspapers of general circulation in the area in which the members reside. Such notice shall specify a date and place for the holding of a mass meeting of those who have signed this agreement for the purpose of having those signers attending such meetings determine, by a majority vote, if a sufficient sign-up has been obtained to justify the formation and operation of the association, and their conclusion shall be final. Fol-

lowing the holding of such a meeting, notice of the action there taken shall be published in one or more newspapers of general circulation in the area.

5. After the giving of a notice as above provided that a sufficient sign-up has been obtained to justify the operation of the association, all subscribers hereto shall deliver their fruit and/or vegetables to the association in accordance with the marketing agreement.

6. The organization committee shall keep a full, true and detailed account of all expenditures of every kind and shall have such accounts audited and render a written report thereof to the board of directors of the association when organized, and shall thereupon turn over to the association any balance remaining in its hands free of obligation. If it is not so organized, such unexpended balance shall be prorated among the signers hereof who have paid their organization fees.

7. The association, when organized, shall endeavor to secure signatures of additional growers to the marketing agreement.

8. The subscriber applies for membership in the association when organized and expressly agrees that signature to the marketing agreement shall be deemed to all intents and purposes the same as signature to this organization agreement; all of which shall be irrevocable except as provided in section 4 of this organization agreement, section 13 of the Marketing Agreement, or the by-laws of the Association, and he so agrees in order to induce other growers to sign this agreement for his benefit, as well as their own general benefit and the public welfare.

9. Acceptance of this application for membership and the marketing agreement shall be deemed conclusive upon the mailing, by the Association, of a notice to that effect to the subscriber at his address noted below, and such mailing and notice shall be conclusively established by the affidavit of the secretary of the association.

10. The subscriber agrees to be bound by the terms of the following marketing agreement:

MARKETING AGREEMENT

THIS AGREEMENT between the.. Association hereinafter called the "Association" and the undersigned, hereinafter called the "Grower,"
WITNESSETH:

(1) The Association buys and the Grower sells to the Association all fruits and/or vegetables except those which the Grower reserves for his own personal use, but not for sale, produced by or for him or acquired by him as landlord or lessor and the Grower agrees to deliver all such fruits and/or vegetables at such place or places as the Association may direct. This contract is intended by the parties to pass an absolute title to all such fruit and/or vegetables as soon as the same have a potential existence but shall be at the risk of Grower until delivery. The Association is authorized to exercise any and/or all powers conferred upon it hereunder through any central agency of which this and any other similar associations are members.

(2) The Association agrees that on the delivery of fruits and/or vegetables hereunder that it may make such advances to the Grower on such fruits and/or vegetables as in the discretion of the directors may be justified by marketing conditions.

(3) The Association agrees to sell such fruits and/or vegetables, together with fruits and/or vegetables delivered by other growers and to pay over ratably the net amount received therefrom as payment in full to the Grower, after making deductions to cover advances, interest upon advances, the cost of picking, gathering, harvesting, receiving, assembling, handling, grading, packing, inspecting, processing, financing, advertising, storing, insuring, selling and marketing such fruits and/or vegetables; and for organization, operating and maintenance expenses, stock in a central agency, and reserves, but such reserves shall not exceed..........................per cent of the gross sale price, which reserves may be used by the Association for any proper purpose.

(4) All fruits and/or vegetables shall be delivered at the earliest reasonable time after harvesting, at such places as the Association may direct, and each package of fruits and/or vegetables delivered to the Association shall be marked for identification purposes in the manner prescribed by the Association at the Growers expense.

(5) Any loss that the Association may suffer on account of inferior or damaged condition at delivery shall be charged against the Grower, individually.

(6) The Grower further agrees that the Association and/or the central marketing agency shall have the power to borrow money for any purpose of the Association, and/or the central marketing agency on the fruits and/or vegetables delivered to the Association, and in its absolute discretion the Association and/or the central marketing agency may grade, pool, or commingle such fruits and/or vegetables or any part thereof, with other fruits and/or vegetables of like grade

and variety; and shall exercise all other rights of ownership without limitation; and sell or pledge for its own account, or as security for its own debts or otherwise, all or any such part of such fruits and/or vegetables or bills of lading, warehouse receipts, sale accounts, or other documents covering said fruits and/or vegetables, or received on account thereof.

(7) Inasmuch as the remedy at law would be inadequate and inasmuch as it would be impracticable and extremely difficult to determine the actual damage resulting to the Association should the Grower fail to deliver the fruits and/or vegetables hereby sold, regardless of the cause of such failure, the Grower hereby agrees to pay to the Association for all fruits and/or vegetables delivered or disposed of, by or for him, other than in accordance with the terms hereof, the sum of......................................cents per package on all fruits and/or vegetables, as liquidated damages for the breach of this contract; all parties agreeing that this contract is one of a series dependent for its true value upon the adherence of each and all of the contracting parties to each and all of the said contracts, but the cancellation of this contract or the failure of Growers to comply herewith shall not affect other similar contracts.

(8) If the Association brings any action whatsoever by reason of a breach or threatened breach hereof, the Grower shall pay all costs of court, costs for bonds and otherwise, expense of travel and all expenses arising out of or caused by the litigation, and reasonable attorney fees expended or incurred by it in such proceedings and all such costs and expenses shall be included in the judgment.

(9) It is agreed that the charter, the by-laws now or hereafter in effect, and this contract constitute the entire agreement between the Association and the Grower.

(10) The Association may enter into agreements with other growers differing in terms from those contained herein, but consistent with the by-laws of the Association without invalidating this contract, provided that the Grower at his request may sign a similar contract as a substitute for this agreement.

(11) By signing this agreement the Grower applies for membership in the Association and the signing hereof by the Association shall constitute an acceptance hereof.

(12) The Association shall make rules and regulations and provide inspectors or graders to standardize and grade the fruits and/or vegetables and the methods of handling and shipping the same and the Grower agrees to accept and abide by any such rules and regulations and to accept and abide by the grading established by the Association. The Association and/or said central agency shall provide for the inspection of all fruits and/or vegetables delivered hereunder, and if any such fruits and/or vegetables are not in proper condition

for sale they shall be sorted and prepared for sale at the expense of the Grower.

(13) After two crops of fruits and/or vegetables have been delivered to the Association hereunder, either party hereto may cancel this contract on August 15th of any year thereafter by notifying the other party in writing of this intention, such notice to be given during the month of July immediately prior to the effective date of cancellation. If neither of the parties hereto cancels this agreement on August 15th of any year, as aforesaid, it is hereby mutually agreed that this shall constitute conclusive evidence that the parties hereto have renewed this contract for another year. When any grower has exercised this privilege of cancellation he shall not be readmitted to membership until the expiration of one year and then only on a vote of the board of directors of the Association.

(14) If there is a lien on any of the fruits and/or vegetables delivered hereunder, Grower authorizes the Association and/or central agency to pay the holder of said lien from the proceeds derived from the sale of such fruits and/or vegetables before any payment is made to Grower hereunder.

(15) The parties agree that there are no oral or other conditions, promises, covenants, representations or inducements in addition to or at variance with any of the terms hereof; and that this agreement represents the voluntary and clear understanding of both parties fully and completely. Read, considered and signed at..
this.......................................day of..., 193.......

(Do not sign without reading)

Grower's signature.. (...)

(Print Grower's name here)

Address.. ....

(R. F. D. or Street No.) (Town)

County ....State ....

Accepted at..................................., ..., this.............................day

of..., 193......, in accordance with a resolution of the board of directors.

....Association

By...Secretary.

BY-LAWS

of

....Association.

ARTICLE I—Purposes and Powers

The purposes for which this association is formed, and the powers which it may exercise, are set forth in the Articles of Incorporation of the Association.

ARTICLE II—Directors and Officers

Section 1. Number—The business of the association shall be controlled by a board of directors of seven (7) or more members.

Section 2. Election—The directors shall be elected annually by ballot at the annual meeting of the members from the membership of the association, and shall hold office until their successors shall have been elected and qualified, and have entered upon the discharge of their duties.

Section 3. Election of Officers—The board of directors shall meet within ten (10) days after the first election and within ten (10) days after each annual election, and shall elect by ballot a president, vice-president, secretary, and treasurer (or a secretary-treasurer), each of whom shall hold office until the election and qualification of his successor unless earlier removed by death, resignation or for cause. The president and vice-president only need be members of the board of directors.

Section 4. Vacancies—Whenever a vacancy occurs in the board of directors, other than for the expiration of a term of office, the remaining directors shall appoint a member to fill the vacancy to serve until the next regular meeting of the members.

Section 5. Board Meetings—In addition to the first meeting mentioned above, regular meetings of the board of directors shall be held (monthly, quarterly, or semi-annually or at such times and places as the board may determine).

Section 6. Special Meetings—A special meeting of the board of directors shall be held whenever called by the president or by a majority of the directors. Any and all business may be transacted at a special meeting. Each call for a special meeting shall be in writing, signed by the person or persons making the same, addressed and delivered to the secretary, and shall state the time and place of such meeting.

Section 7. Notice of Board Meetings—Notice of the regular or special meetings of the directors shall be mailed to each director at least five (5) days prior to the time of such meeting.

Section 8. Compensation—The compensation of the board of directors shall be determined by the members of the association at any annual or special meeting of the Association.

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Section 9. Quorum—A majority of the board of directors shall constitute a quorum at any meeting of the board.

ARTICLE III—Duties of Directors

Section 1. Management of Business—The board of directors shall have general supervision and control of the business and the affairs of the Association and shall make all rules and regulations not inconsistent with law or with these by-laws, for the management of the business and the guidance of the officers, employees, and agents of the Association. They shall have installed an accounting system which shall be adequate to the requirements of the business, and it shall be their duty to require proper records to be kept of all business transactions.

Section 2. Employment of Manager—The board of directors shall have power to employ or to authorize the employment of a manager and such other employees as may be deemed necessary, and to fix their compensation. The manager shall have charge of the business of the association under the direction of the board of directors. No director shall serve as manager.

Section 3. Bonds and Insurance—The board of directors shall require the manager and all other officers, agents, and employees charged by the association with responsibility for the custody of any of its funds or property to give adequate bonds. Such bonds shall be furnished by a responsible bonding company and approved by the board of directors, and the cost thereof shall be paid by the Association. The board of directors shall provide for the adequate insurance of the property of the Association, including fruit and/or vegetables and property of all kinds, regardless of ownership, which may be in the possession of the Association, or stored by it, and in addition shall provide for adequate employers' liability insurance for all employees.

Section 4. Audits—At least once in each year the board of directors shall secure the services of a competent and disinterested public auditor or accountant, who shall make a careful audit of the books and accounts of the association and render a report in writing thereon, which report shall be submitted to the members of the Association at their annual meeting. This report shall include at least: (1) A balance sheet showing the true assets and liabilities of the Association; (2) an operating statement for the fiscal period under review which shall show the cost of, and income from sales and the gross income or loss from each of the commodities handled during the period; (3) an itemized statement of all expenses for the period under review.

Section 5. Marketing Agreements—The board of directors shall have the power to carry out the marketing agreements of the Association with its producer members, in every way advantageous to the Association representing the producers collectively.

Section 6. Depository—The board of directors shall have the power to select one or more banks to act as depository of the funds of the Association and to determine the manner of receiving, depositing, and disbursing the funds of the Association and the form of check and the person or persons by whom same shall be signed, with the power to change such banks and the person or persons signing such checks and the form thereof at will.

Section 7. Membership Certificates—The board of directors shall cause to be issued appropriate certificates of membership.

ARTICLE IV—Duties of Officers

Section 1. Duties of President—The president shall (1) preside over all meetings of the association and of the board of directors, (2) call special meetings of the association and of the board of directors, (3) perform all acts and duties usually performed by an executive and presiding officer, and (4) sign all membership certificates and such other papers of the association as he may be authorized or directed to sign by the board of directors, provided, the board of directors may authorize any person to sign any or all checks, contracts and other instruments in writing on behalf of the association. The president shall perform such duties as may be prescribed by the board of directors.

Section 2. Duties of Vice-President—In the absence or disability of the president, the vice-president shall perform the duties of the president; provided, however, that in case of death, resignation or disability of the president, the board of directors may declare the office vacant and elect his successor.

Section 3. Duties of Secretary—The secretary shall keep a complete record of all meetings of the association and of the board of directors and shall have general charge and supervision of the books and records of the association. He shall sign all membership certificates with the president and such other papers pertaining to the association as he may be authorized or directed to do by the board of directors. He shall serve all notices required by law and by these by-laws and shall make a full report of all matters and business pertaining to his office to the members at the annual meeting. He shall keep the corporate seal and the book of blank membership certificates; complete and countersign all certificates issued and affix said corporate seal to all papers requiring seal. He shall keep a proper membership book, showing the name of each member of the association, the number of his membership certificate, and date of issuance, surrender, cancellation or forfeiture. He shall act as secretary of the executive committee. He shall make all reports required by law and shall perform such other duties as may be required of him by the association or the board of directors. Upon the election of his successor, the secretary shall turn over to him all books and other property belonging to the association that he may have in his possession.

Section 4. Treasurer—The treasurer shall perform such duties with respect to the finances of the association as may be prescribed by the board of directors.

ARTICLE V—Executive Committee

Section 1. Powers and Duties—The board of directors may in their discretion appoint from their own membership an executive committee of three (3) members, determine their tenure of office, their powers and duties and fix their compensation. The executive committee shall have such powers and duties as may, from time to time, be prescribed by the board of directors and these duties and powers may be all of the duties and powers of the said board of directors, subject to the general direction, approval and control of the board of directors. Copies of the minutes of the meetings of the executive committee and any reports thereof shall be mailed to all directors, within seven (7) days following such meeting.

ARTICLE VI—Duties of Manager

Section 1. In General—Under the direction of the board of directors the manager shall have charge of the ordinary and usual business operations of the association, including the purchasing, marketing and handling of all products and supplies handled by the association. He shall, so far as practicable, endeavor to conduct the business in such a manner that the members will receive just and fair treatment. The manager shall deposit all money belonging to the association which comes into his possession in the name of the association in a bank selected by the board of directors and he shall make all disbursements therefrom for the ordinary and necessary expenses of the business by check in the manner and form authorized by the board. Upon the appointment of his successor, the manager shall deliver to him all money and property belonging to the association which he has in his possession or over which he has control.

Section 2. Duty to Account—The manager shall be required to maintain his records and accounts in such manner that the true and correct condition of the business may be ascertained therefrom at any time. He shall render annual and periodical statements in the form and in the manner prescribed by the board of directors. He shall carefully preserve all books, documents, correspondence, and records of whatever kind pertaining to the business which may come into his possession.

Section 3. Control of Help—Subject to the approval of the board of directors, the manager shall have control over and may employ and dismiss all agents and employees of the association not specifically employed by the board of directors.

ARTICLE VII—Members

Section 1. Qualifications—Any person, firm, partnership, corporation or association, including both landlords and tenants in share tenancies, who is bona fide grower of fruit and/or vegetables in the territory tributary to the shipping point of this association and who is of good character may become a member of the association by executing the marketing agreement, and meeting such other conditions as may be prescribed by the board of directors.

Section 2. Membership Certificates—This association shall issue a certificate of membership to each member. The membership certificate shall be in such form as may be prescribed by the directors but shall not be transferable.

Section 3. Expulsion—If any member shall cease, fail, neglect, or refuse for any reason whatsoever to market the fruit and/or vegetables owned or grown by him as provided in the marketing agreement, then the board of directors may cancel his membership and expel him from membership in this association; and all of his rights and interest therein, shall by that act, be cancelled and such member shall be entitled only to payment, as provided by law, of the equitable appraised value of his interest in the property of the association.

Section 4. Withdrawal—Any member may withdraw from the association as provided in the marketing agreement, but such withdrawal shall not affect any right or lien which the association has against the retiring member or his property until his indebtedness to the association is fully paid.

ARTICLE VIII—Meetings

Section 1. Fiscal Year—The fiscal year of this association shall commence on the first day of..and end on the last day of..

Section 2. Annual Meeting—The annual meeting of the members of this association shall be held in the town of.. State of.., on the last.. in..of each year, at.., if not a legal holiday, but if a legal holiday, on the next business day following.

Section 3. Special Meetings—Special meetings of the members of the association may be called at any time by order of the board of directors, and shall be called at any time upon the written request of at least five per cent of the members, provided that in no case shall the required number of signatures to such a request be less than ten (10). The request shall state the time, place, and object of the meeting.

Section 4. Notice of Meetings—Written or printed notice of meetings for every regular and special meeting of members shall be prepared and mailed to the last known post office address of each

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member not less than ten (10) days before such meeting. Such notice shall state the object or objects thereof and the time and place of meeting. Such notice in the discretion of the board of directors may be given by publishing the same at least ten (10) days prior to the date of the meeting in a newspaper of general circulation published at the principal place of business of the association. No business shall be transacted at special meetings other than that contained in the call.

Section 5. Quorum—Ten (10) per cent of the members shall constitute a quorum for the transaction of business at any meeting of the association except for the transaction of business concerning which a different quorum is specifically provided by law or by these by-laws.

Section 6. Order of Business—The order of business at the annual meeting shall be:

(1) Roll call
(2) Proof of due notice of meeting
(3) Reading and disposal of minutes
(4) Annual reports of officers and committees
(5) Election of directors
(6) Unfinished business
(7) New business
(8) Adjournment

ARTICLE IX—Miscellaneous Provisions

Section 1. Borrowing Money—The association shall have the power to borrow money for any corporate purposes on open account or upon any assets of the association, or on any property of members in its possession or upon any accounts thereof or any property not yet distributed to the members, in such amounts and upon such terms and conditions as may from time to time, seem to the board of directors advisable or necessary.

Section 2. By-Laws Printed—After adoption, these by-laws, preceded by the articles of incorporation, shall be printed in pamphlet form and a copy thereof shall be delivered to each member and to each person who may later become a member of the association hereafter as shown on the books of records.

Section 3. Seal—The seal of the association shall contain these words and figures: ".. Association, Incorporated, 193......" in circular form, the impress of which is placed hereon.

ARTICLE X—Amendments

These by-laws may be altered or amended at any regular or special meeting of the members by the affirmative vote of three-fourths or more of the members present.

We, the undersigned, being all of the members of the............................ ....Association, do hereby assent to the foregoing by-laws and do adopt the same as the by-laws of said association.

IN WITNESS WHEREOF, we have hereunto subscribed our names, this..............................day of..193.........

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